

THE TREATMENT OF CATARACT

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WITH APPENDIX BY

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PREFACE

I HAVE written this Monograph at the request of many members of the profession. It was written in the few hours which I could spare from work and is, in consequence, in many respects possibly not as well rounded up as critics would like. However, it is based on my own personal experience which at the time of writing is over 24,000 cataract extractions.

Regarding the Appendix I have to tender Captain A. E. J. Lister, F.R.C.S., I.M.S., my sincere thanks for all the trouble he took with this important chapter and with the subject thereof. I had the records searched by two members of the profession not connected with the institution. They found about 500 cases of escape of vitreous recorded and selected out their original bed-head tickets. I had these patients invited to pay me a visit through the office of their respective District Magistrates. We, of course, could put no pressure on them to visit us. Captain Lister examined those who came, their original bed-head tickets being before him. The results of that examination he records in that Appendix. He excluded none and there is no reason to think that those who came are not representative of the 500 cases.

I am also greatly indebted to Captain Lister for many valuable suggestions throughout the Monograph and for all the trouble he has taken with the correction of the proofs and with the making out of the Index

I have to thank Dr Vail of Cincinnati for the sketches throughout the Monograph. These he did in the autumn of 1909 in the operating room of Jullundur from the actual operation

I note with pleasure the growing favour with which extraction of cataract in the capsule is being received by the broad-minded profession in America and in India

The Literature of extraction in the capsule is as yet small. By far the most important papers yet written on the subject are those read at the Bombay Medical Congress, February, 1909, and obtainable with the other proceedings of that Congress from "The Times of India" office, Bombay, in book form and the Ophthalmic Record of Chicago, February 1910

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CHAPTER I.

THE DIAGNOSIS AND CLASSIFICATION OF CATARACT AND THE OPERATION TO WHICH EACH VARIETY IS BEST SUITED

THE student—we are all students—should by careful and repeated observations to impress on his mind a picture of the naked eye appearance in health of the conjunctiva, the sclerotic, the cornea, the sclero-corneal junction, the depth of the anterior chamber, the iris and its lustre, the pupil, its size and its reaction to light

To have an exact mental impression of these points as seen in health to such a degree that the slightest variation from health is noticed with the quickness and ease of intuition, is just as necessary to the ophthalmic surgeon as it is to the physician who deals with diseases of the chest, for example, to have fixed on his mind the normal sounds of the chest

The student of this subject should be obliged to do a course of observation with his naked eye, and it should be seen that he is thoroughly competent in observing all that is to be seen in health, and all visible variations from health before he proceeds to use instruments for further observation

The information which is to be gained at a glance by a trained eye is much farther reaching than is commonly taught, and it should be used as a mental guide as far as possible to what the observer is to expect on examining with instruments. In this way the observer gets all the facts available except those told him by the patient and those his finger tips give him. The training of the finger tips in determining tension is equally important. They tell him much of what his eye can tell him as regards tension and he obtains a

more delicate estimate with them concerning tension than by any instrument, always presuming that they are trained in the art

My experience of men who have just finished a course of study at ophthalmic teaching hospitals is that at the end of it they are often unable to notice gross deviations from health with their naked eye. They can use the ophthalmoscope and the retinoscope, they can describe conditions of the fundus and correct errors of refraction. They know all about ophthalmic instruments and could do any examination on paper but put them before a patient with only their naked eye, and without allowing them to ask questions, their capacity for seeing what to a trained eye is at once evident is often very little. Their training has been commenced at the wrong end. The training of the most important of all the organs of observation has been comparatively neglected—that organ which should be used to the maximum limit of its power before instruments are taken up.

The naked eye, as far as cataract is concerned, if trained, leaves exceedingly little for other instruments of observation to discover. In the case of mature cataract I seldom have occasion to use anything other than the naked eye except the fingers to determine tension—a condition which is generally evident to the naked eye from the general appearances. In the case of immature cataract, it may be necessary to examine by lateral illumination or by reflected light to see the degree to which the opacity has developed. I now assume that the surgeon is familiar with the naked eye appearances of the healthy conjunctiva, sclerotic, cornea, sclero-corneal junction, the depth of the anterior chamber, the lustre of the iris, the reaction of the pupil to light, and the tension of the eyeball as determined by the fingers, and that he can examine an eye by lateral illumination and by reflected light. We have of course to depend on the patient for information on the projection of light—a thing we should never fail to determine as on it and on the reaction of the



Fig 1 Showing the method of "taking the tension" by means of the pulp of the index finger of the right hand laid directly against the eyeball below the cornea

This is a painless method and gives a very accurate idea of what the tension is

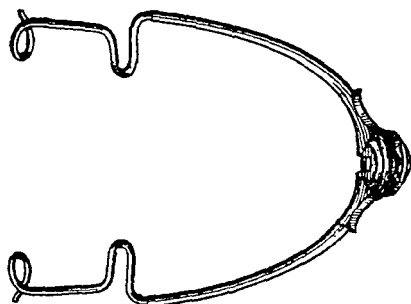


Fig 2 Speculum with spring and stop in joint



Fig 3 Showing the proper way of holding the speculum for introduction



Fig 4 Showing the method of exposing the eyeball and cul de sacs for irrigation. The operator grasps the brow with a claw-like grip to overcome the corrugator supercilii and draw the tissue of the fornix up towards the rim of the orbit, while the left hand lifts the eyelids on the speculum away from the eyeball ad maximum. Thus opening the fornices like a sack for thorough douching just prior to the operation.

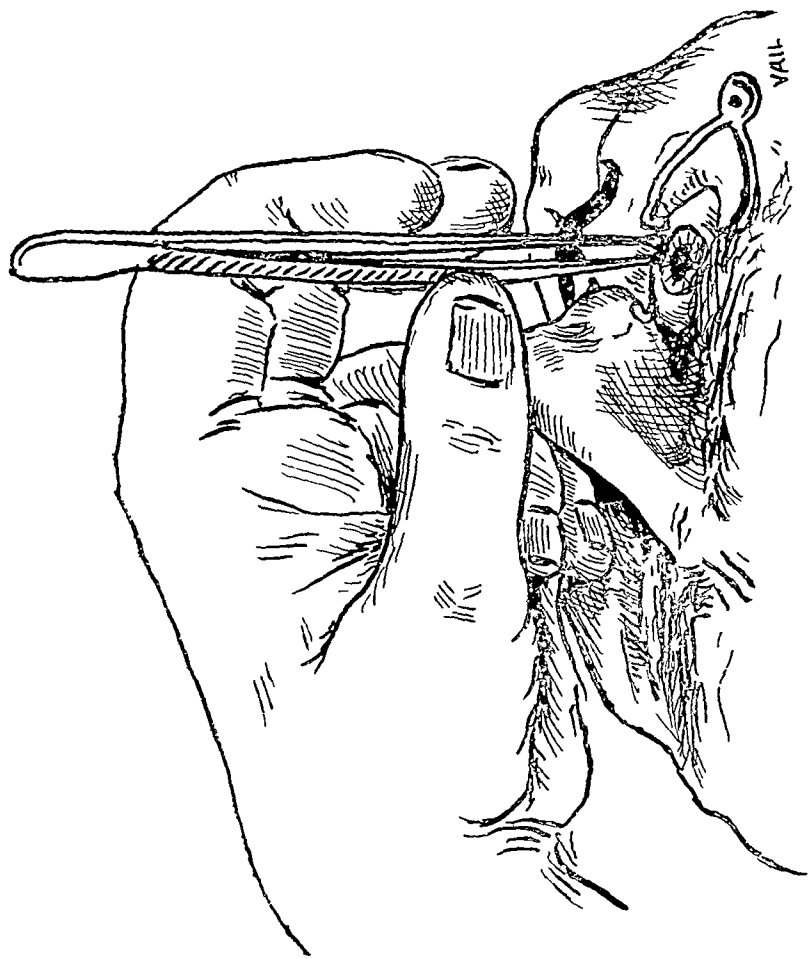


Fig 5 Showing position of the left hand in grasping and steadying the right eye for section. Notice how the fingers and thumb are in a position to steady the patient's head, also that the eye is rotated slightly outward to allow room for the section without the point of the knife encountering the side of the nose

pupil to light we have to depend for our information concerning the condition of the visual function of the retina. If the iris is adherent or if atropine or other mydriatic has recently been used, we have to depend on the projection of light alone. If the iris is not adherent, the one is as good an indicator as the other. The reaction of the pupil has the great advantage that by it we are independent of the patient and in many cases our estimate is much sounder when independent of him, as in many instances the patient's estimate lacks scientific accuracy, whereas the reaction of the pupil to light is not under his control and it is thus scientifically accurate in its indication.

I shall now classify cataracts from a clinical point of view, give points in diagnosis and indicate the operation to which each variety is best suited.

- (1) Immature cataract
- (2) Intumescent cataract
- (3) Mature cataract
- (4) Hypermature cataract
- (5) Hard cataract
- (6) Black cataract
- (7) Traumatic cataract
- (8) Anterior and posterior polar cataract
- (9) Circumscribed congenital stationary cataract
- (10) Lamellar cataract
- (11) Complicated cataract
- (12) Soft cataract (children and juveniles).

1 *Immature Cataract*—In uncomplicated immature cataract, the patient tells us that his vision has been failing for some time, that he can see better in a dull than in a bright light. He sees better in the dull light because the pupil dilates and thus allows him to see through the more transparent peripheral portion of the lens, whereas it contracts in a bright light and allows him to see only through the more central portion which is the most opaque part of the immature lens. These facts are intensified in the case of the opium-eater who suffers most inconvenience from immature cataract.

owing to the contracted condition of his pupil. The opium-eater is thus anxious to have his lens extracted earlier than any other. The opium pupil is characteristic and is not to be confused with any other drug pupil. It is contracted. Its characteristic is that its reaction to light is of almost lightning-like quickness, so quick that the observer requires to be himself quick if he is to observe it. Its range of contraction and dilatation is not extensive. If the surgeon examines immature cataract in elderly cases for errors of refraction, he will often find that a low cylinder improves their vision owing to the fact that the lens in this condition often tends to become astigmatic, and that they see better with a lower power sphere than they have been accustomed to use owing to the index of refraction of the lens having increased. Atropine drops are used for almost every disease of the eye by practitioners not familiar with ophthalmology or with the risk they are running in its use. If it has been used for these patients and they tell us that they like the effect as it gives them better vision, the surgeon should in no case countenance the use of this drug for this purpose as he is running the risk of setting up an acute glaucoma and a form of conjunctivitis often associated with its frequent use. The surgeon can see an immature cataract with his naked eye, if at all advanced. If he cannot see it with his naked eye, he can see it with the ophthalmoscope and by lateral illumination as an opacity of greater or lesser degree in the central portion of the lens. He can also see with the naked eye that the anterior chamber is the depth of the anterior chamber in health, which indicates that the immature lens is the size of the normal lens. The lens in the stage of immaturity does not become appreciably altered in size and very little in either shape or consistency. When the lens becomes so opaque that vision is no longer useful for ordinary practical purposes, it should be extracted in the capsule.

If the surgeon does not like to adopt this procedure, he would be better advised to wait until it ripens. Ripening procedures are, I think, generally given up, and rightly so.

The natural process of ripening of a cataract occupies a very variable time—often years. The objection to extracting an immature cataract by capsulotomy is that it is exceedingly difficult to avoid leaving much of the cortex adherent to the capsule, which with the capsule is very liable to set up a severe form of iritis and to result in a very dense after-cataract. In such dense after-cataracts with or without iritis, needling is not satisfactory. It is a difficult operation and the openings are liable to close from the elasticity of the membrane, and when done, it is a permanent source of irritation to the eye. In such cases the procedure I find most satisfactory is to extract the after-cataract (*vide* Chapter on After-Cataract).

I wish here to emphasise the fact that the ideal method of treating immature cataract is to extract the lens in its capsule by the method described in Chapter IV.

The extraction of the cataractous lens in its immature state presents no difficulty whatever by this method, and by this method the special difficulties and complications, which are met with when it is treated by Daviel's operation, are non-existent.

If this class of cataract were extracted in the capsule, patients would often be saved many years of anxious waiting and mental suffering, coupled frequently with heavy pecuniary loss, owing to their being unable to see to do their work. I hold that for this class of case alone, if for no other, every practising ophthalmic surgeon should be acquainted with and able to perform extraction in the capsule.

The above statement is my answer to the question which has often been asked me by European ophthalmologists as to whether the operation of extraction in the capsule is only applicable to very mature cataracts.

2 *Intumescent Cataract*—This is a ripe cataract. This is the stage which generally follows the previous class and there is no transition line between them.

In the uncomplicated intumescent cataract, the patient tells us that he has practically no vision and no *pain*, that he

can distinguish day from night and a bright light from a dull light, and if the open hand be drawn across in front of his eye in a good light, that he recognises that something is being moved across in front of his eye. This is his "recognition" of light, a thing which the operator should never fail to test as an indication of the acuteness of the visual function of the retina in these cases. His recognition of reflected light in the dark room will be in harmony with this. The surgeon should now place the patient on his back in a good light from which the direct rays of the sun are excluded, and with the patient's eyelids held open, he should alternately allow the eye to be exposed to the light and shaded from it by his hand in front of the eye, taking care when removing the hand to do it quickly. By this means he can observe the reaction of the pupil to light (as well as his recognition of light), its range and its quickness. The quickness of this reaction of the pupil is as accurate an indicator of the condition of the visual function of the retina as the galvanometer is of an electric current. The observer can get or observe this reaction much better with the patient on his back than in the erect position.

The surgeon observes that in this variety the anterior chamber is shallower than in the normal eye—its shallowness may vary up to almost complete disappearance. If very shallow, the range of reaction of the pupil may be normal, but its sharpness may be diminished owing to the pressure of the lens from behind, and when such is the case, the inference is that the visual function of the retina is good, a thing which the recognition of the light indicates. These lenses are much larger than the normal lens, and of course they vary much in size. The smaller ones are of a shape varying between the shape of a normal lens and of a sphere approximating more to the shape of a lens than to the shape of a sphere. The larger ones are more spheroidal in shape than lenticular. In this stage the lens cortex has become disintegrated and has absorbed an undue proportion of moisture, hence its size. The nucleus of these lenses is of variable size, the age of the

patient having some influence on the size of the nucleus, the older the patient, the larger the nucleus. The nucleus in these cases is surrounded by matter of a grape juice or thin whipped jelly consistency. The capsule of this class is generally weak and easily ruptured. This lens in position appears to the naked eye to have a well-marked floccular or wavy appearance which has no connection in the direction of the flocculæ or waves with the radial striæ seen in hard cataract and in some immature cataracts. This appearance has the characteristic sheen of the wavy appearance seen in pearl when placed against a dark background. These naked eye appearances are characteristic, and it is very important that the operator who intends to extract in the capsule should recognise them, as will be pointed out in the chapter dealing with that subject. This variety is suitable for extraction in the capsule or for the capsulotomy operation.

3 *Mature Cataract*—After a period of time the soft matter of the previous variety gradually becomes more liquid and absorption goes on until the lens once more becomes its normal size, though not its normal shape, and the anterior chamber resumes its normal depth. It is then termed mature, though the previous variety is as opaque to light as it is. The patient tells the same story as in the previous variety. The lustre of this lens is uniform or practically uniform and of a whitish colour in some instances, a bluish white in others. The other remarks concerning the previous variety apply to this one. This variety is suitable for the intracapsular or for the capsulotomy operation. A cataract is generally regarded to be mature or operable by the capsulotomy method, other things being normal, when the patient has ceased to be able to count the fingers of the opened hand placed six or eight inches distant from the patient between him and a good light.

4 *Hyperature Cataracts* are of two varieties (a) when the absorption of the cortex of the lens in the previous (class 3)

has progressed to its disappearance or almost to its disappearance, leaving little more than the nucleus in a dense capsule it is regarded as hypermature. This is the hypermature cataract of writers on the subject. It is in my observation comparatively rare. (b) Hypermature cataract in my observation does not generally pass through the stages of intumescence, maturity (as described in class 3) and hypermaturity (as above described). It is generally in my observation a special form of development in itself *ab initio*. Hypermature cataract, as described above, when extracted in the capsule, will be the shape of the nucleus in the ordinary mature lens (class 3). Such in my observation is rare. I have extracted hypermature cataracts in considerable numbers at all stages of their development (immaturity included) in their capsules.

In this variety, opacity and absorption seem to progress *pari passu* without any oedematous swelling or appreciable softening of the cortex. Before operation the anterior chamber will be observed to be deep and the iris occasionally tremulous.

When extracted, this variety will be observed to have been absorbed antero-posteriorly, entirely out of proportion to its absorption peripherally. It is a hard cataract whose convexity, so to speak, has become greatly diminished. Its transverse diameter may be very little less than that of a normal lens, though in this respect it varies considerably. Its peripheral border is generally thin and sharp and its capsule dense and tough, when extracted in the capsule, and put beside one of (a) variety, it will be observed that the latter is of lenticular shape, whereas the former is comparatively flat, thin and broad.

Both are possessed of a very dense capsule, probably due to the shrinkage of the capsule which progresses with the absorption of the lens matter.

This lens, when mature, has a characteristic uniform white appearance, somewhat the colour of polished bone or ordinary coarse white soap.

It is very important in either the capsulotomy or intra-

capsular operation that this lens be diagnosed before operation. Its small size and its colour are its leading characteristics. Its capsule is dense and tough. Its suspensory ligament is generally said to be weak, but such is not my experience. I generally find it stronger than in any other variety as determined by the difficulty in dislocating it in the intracapsular operation.

The statement, that the suspensory ligament of this variety is weak, made by all writers on the subject, seems to me to be based on the fact that this lens is very often dislocated in the process of lacerating its capsule—so dense and tough is its capsule. Those who extract this lens by the capsulotomy operation would do well to see that their capsulotomy instrument is really sharp and that their hand is light. This variety is not suitable for the capsulotomy operation unless the operator is prepared to tear out the capsule after the escape of most of its contents as the capsule is dense, and it is as difficult to get the cortical matter freed from the capsule as is the case in immature cataract or more so, hence the density of the after-cataract.

In the intracapsular operation it always dislocates first at the middle of the wound in the cornea and generally refuses to move further without the aid of a spoon or spatula introduced beneath it to prevent it from sinking into the vitreous. In those instances in which it is a mere membrane it should be torn out with forceps.

In the intracapsular operation in skilled hands vitreous is more liable to escape in extracting hypermature cataract than in any other class, and the same applies to the capsulotomy operation owing to the frequency with which this lens is dislocated in the process of lacerating its capsule.

We frequently see it stated that hypermature cataract is often partially dislocated by nature. This seems to me an error of observation, as in my large experience I have never yet come across one. The dislocation found in the process of extracting by the capsulotomy method is due to the operator overlooking the fact that he has actually

dislocated it in the process of lacerating its dense tough capsule

5 *Hard Cataract*—This variety introduces us to a cross division. This variety is found only in advanced age, in it the lens is the size and shape of the normal lens. It has generally gradually sclerosed throughout. The radiating striæ are evident and its colour is generally light amber. In this variety, we often meet with cases in which there is a small amount of soft matter between the nucleus and the capsule which makes it look somewhat white in colour. Under this heading we appropriately come to—

6 *Black Cataract*—These, again, are to be found chiefly in advanced life. They are of the consistence of either of the varieties of *hard cataract*. We see them in all stages of their development from light amber to black. This applies to the nucleus. If there is no soft matter in the capsule, they show their exact colour to the naked eye. If there is soft matter surrounding the nucleus, we may or may not be able to diagnose them with the naked eye, until after we have extracted them, according to the amount of soft matter present. The nucleus can be seen through the whitish soft matter to be black by lateral illumination. From the diagnostic point of view, the pure black cataract is interesting. The inexperienced will require reflected light to recognize that it is a cataract owing to the fact that to the naked eye it is the colour of a normal pupil.

In the ordinary hard cataract, the patient's recognition of light is poorer than in the varieties previously described. The patient's capacity for recognizing light decreases through the different shades of amber to black. The cause of this is that these lenses transmit but little light to the retina, the amount depending on the degree of colour through the various shades of amber to black. In black cataract the fundus may be good with poor recognition of light and poor reaction of the pupil to light. The operator in these varieties of cataract should expect a good fundus with these

factors poor in proportion to the depth of colour of the lens, always assuming that the other factors are normal

7 *Traumatic Cataract*—Traumatic cataracts are of two varieties in one, the lens is partially dislocated by a blow which does not injure the cornea and it becomes cataractous

In this case the injury sufficient to dislocate the lens generally causes rupture of the coats of the eyeball posteriorly, and this causes a dislocation of a portion of the retina. In this case the surgeon should wait a little before extracting the lens until the detachment of the retina has been cured or rendered stationary when, if the reaction of the pupil to light indicates useful vision in the fundus, he should extract the lens in its capsule

The capsule of this lens is not ruptured, hence there is no immediate necessity for its extraction. In the other variety the cataract has been caused by a penetrating wound of the cornea which ruptures the capsule of the lens and may, in addition, dislocate the lens. Thus, the lens matter becomes opaque, swells up, and makes its way into the aqueous chambers. Assuming the corneal wound becomes at once sealed up if this case be not operated on immediately, a severe iritis and a subsequent cyclitis with rise of tension set in and destroy the eye beyond hope in a few days which may be followed by sympathetic ophthalmia in the other eye if the first be not enucleated early

The picture the eye usually presents when the patient comes to us if 24 hours have elapsed is an unhealthy-looking wound of the cornea, the iris adherent all round to the lens, the anterior chamber very shallow from the swelling of the lens, the anterior chamber may be obliterated, and the lens and margin of the iris may even be adherent to the wound in the cornea. In spite of the wound in the cornea and the iritis, it is imperative that the eye should be operated on without delay on account of the dangers incurred by waiting. The eye should be cocaineized and the ulcer or ulcerated wound (as it generally is) cleaned with a douche of 1 in 2000

solution of bichloride of mercury, after which the ulcerated wound should be well touched up with a small swab containing 60 grains nitrate of silver in an ounce of distilled water and again douched with the bichloride solution. The operator should then proceed and make a sclero-corneal incision where most clear cornea is available, do a large iridectomy, making sure to catch the iris as close to its pupillary margin as possible, and extract the lens. The operator who proceeds thus with these cases will do the best for his patient. These cases often do well if promptly dealt with.

8 *Anterior and Posterior Polar Cataract*—Anterior polar cataract is generally stationary. It is visible to the naked eye, it may be congenital or acquired. When congenital, it consists in a small central speck in or immediately behind the anterior portion of the capsule. When acquired, it varies in size and in position, and consists in opacity of the same structures. In the acquired variety, it has its origin in a perforating ulcer of the cornea which, if small, in early childhood often completely disappears, leaving no opacity of the cornea. The ulcer having healed, the anterior chamber reforms and the connection between the cornea and the lens disappears. In the acquired variety the layer of opaque tissue may be so thick as to make the anterior pole conical, hence the term pyramidal applied to such cataracts. These cataracts seldom interfere much with vision.

In case the opacity occupies much of the lens exposed by the pupil, an iridectomy should be done where there is most clear lens.

The *posterior polar cataract* is always congenital and is the remains of the connection of the hyaloid artery with the lens in early life and is in and behind the lens capsule. It is visible with the ophthalmoscope and is recognised by its distance from the cornea. It is stationary and interferes but little with vision. It thus requires no treatment.

9 *Circumscribed Congenital stationary opacities*—Various forms of these opacities occur in the substance of the

lens in its central part. The sight in these cases is generally poor from other congenital defects. These opacities seldom cause much impairment of vision. They are to be seen with the ophthalmoscope. If they cause much impairment of vision, the pupil should be dilated, and if a portion of the lens be fairly free, an iridectomy should be done over it. If the prospect with an iridectomy be poor, the lens should be needled in the child and extracted in its capsule in the adult, always provided that the condition of the fundus indicates the possibility of useful vision.

10 *Lamellar Cataract*—This variety is either congenital or found in early childhood. These patients have generally been the subjects of convulsions and generally have or have had rickets of the skull. Lamellar cataract is generally, though not always, stationary. On ophthalmoscopic examination it is seen as a dark central disc showing radii like the spokes of a wheel surrounded by perfectly transparent lens towards its periphery, the transparent part varies considerably, so that in some cases the patient may have very good vision outside the opaque disc. In other cases the opaque disc may obscure the pupillary area. In these cases, if vision is not much impaired, an iridectomy which will expose the transparent periphery of the lens does all that is required. If there is very little of the lens transparent, the case should be treated as an ordinary cataract in a child by needling or extraction.

11 *Complicated Cataract*—By complicated cataract I mean cataract complicated with other disease of the eye.

(a) *Opacities of the Cornea*—In these cases the lens should be extracted by either operation if there is any transparent cornea, an iridectomy being done behind the clear portion at the same time, provided the recognition of light is sufficiently good to indicate useful visual function in the retina.

It should be done even though the margin of the iris be adherent all round to the cornea, in which case we have only got the perception of light through the iris to indicate what

visual function the retina possesses, always provided that due care is taken to observe if there is glaucoma and to deal with the case as regards glaucoma (if it is present) on the principles laid down later on in this section

The results in these cases are very satisfactory, it is remarkable how well a patient can see in these cases through a *very* small clear portion of cornea after cataract extraction

(b) Cataract may be complicated with a partially or totally adherent iris from an old iritis—*Posterior synechia*, if the recognition of light and the reaction of the pupil—if there be any portion of the margin of the iris free—in these cases are reasonably good, the lens should be extracted in the capsule—an iridectomy being done at the same time. No fear need be entertained about the adhesions of the iris, they are very weak and give way readily, leaving iris pigment on the lens. By this method of extraction they should be proceeded with as in an ordinary cataract, the adhesions of the lens give little or no trouble and may be left to take care of themselves during the procedure of extraction in the capsule. It is very important to extract this variety in the capsule as it frees the iris from its adhesions. If extracted by the capsulotomy method, a severe iritis and a dense after-cataract are certain to ensue. If extracted in the capsule, these complications need not be feared, and by this method the results are as good as in cases not thus complicated.

(c) *Glaucomatic Cataract and Cataract in Glaucoma* —By glaucomatic cataract I mean cataract which has glaucoma as its cause. Glaucoma when allowed to progress causes cataract by interfering with the nutrition of the lens, this variety is seldom fit for operation. The condition of the retina is seldom good enough as it has degenerated *pari passu* with the development of the cataract. Glaucoma in this variety is advanced and the surgeon should be able to recognize it at sight. If he makes the mistake of operating for cataract in such an eye, the result will generally be detachment of the choroid immediately after the operation.

with very free and very prolonged hæmorrhage. Such patients have a peculiar stare which in itself is characteristic of advanced glaucoma. The tension is much increased, the cornea has a steamy appearance the iris has lost its normal lustre, the pupil is more or less dilated and its reaction to light is *nil* or very little. The lens has a characteristic marine bluish tint in almost all cases. The conjunctiva presents nothing characteristic, the sclero corneal junction has a peculiar bluish or greenish tint, and the same tint more or less shines through the sclerotic. The vessels of the sclerotic stand out congested and often have a somewhat tortuous appearance. The patient invariably complains of a wearing pain especially in the temple and to a less degree round the orbit. The disease often affects both eyes, but not always. The field of vision is much contracted. In these cases, according to the degree of recognition of light and reaction of the pupil to light there is hope. If these indicate useful visual capacity in the retina the operator should do a large-sized iridectomy, making his incision rather in the sclerotic than in the sclero-corneal junction. He should then draw out the iris, make a cut in one border of the drawn out portion, pull on the iris so as to tear it out at the base, following up the tearing with the scissors, and finally cut the opposite margin with the scissors. The mere excision of a piece of iris is not enough—it should be torn out from its attachment. This is followed by bleeding free in proportion to the degree of advancement of the disease. The blood should be rubbed out by repeated strokes of the tip of the finger, through the upper lid drawing it across the eyeball in the direction of the wound, thus putting on the pressure through the lid until the last trace of blood is thus removed.

This is infinitely the best and most efficient way of clearing blood out of the anterior chamber.

If any blood be left in the anterior chamber, it is very slow in being absorbed in these cases.

Even if there is no perception of light in these cases, an iridectomy is advisable as it seldom fails to relieve the

patient of the wearing pain from which he invariably suffers. It does not always do so, but occasionally, though rarely, intensifies the whole condition

It often arrests the glaucoma at the stage to which it has developed and the eyeball thus resumes its normal tension. If it arrests the glaucoma, we can safely extract the lens after three months, but it is better in these cases to allow six months to elapse before extracting the lens, provided that the perception of light and the reaction of the pupil to light indicate that the retina is in a good enough condition to admit of hopes of useful vision. The patient should be warned not to expect too much in these cases and should be seen occasionally if possible.

Cataract in Glaucoma —By this term I mean cases in which glaucoma has set in during any stage of the normal development of cataract.

I assume that the operator can diagnose acute glaucoma. In these cases if the lens is not of the swollen or intumescent variety, the operator will be well advised if he does a large-sized iridectomy as advised under glaucomatic cataract, having cleared out the bowels and applied half a dozen leeches to the temple beforehand. He can safely extract the lens three months later which is sufficient to allow the eye to resume its normal condition. An iridectomy generally gives a satisfactory result in these cases though not invariably. If the result be not satisfactory, he should not extract the lens. If the lens be of the intumescent variety, the best procedure in my experience is to extract the lens in its capsule, doing an iridectomy at the same time and taking care to have the patient's bowels cleared out before operation and to have applied a few leeches to the temple before operation.

I say, by the intra capsular method in preference to the capsulotomy method, as in these cases we do not want to run any risk of leaving lens matter behind and of the iritis consequent thereon, as these cases are subject to more violent reaction from these causes than an ordinary case is.

Again, when treating the after-cataract left by the capsulotomy method, these eyes are subject to objectionable reaction from such interference. Of course, we are running some risk by extracting the lens during an acute glaucoma, but I think we are running more risk by depending on an iridectomy and waiting for the recovery of the eye, as an iridectomy in these cases very often does not give a very satisfactory result.

INTUMESCENT CASES

Just before or immediately after operation, these cases should get a hypodermic of a third of a grain of morphia on account of the risk of detachment of the choroid, a complication to which they are more subject than ordinary cases.

These cases are subject to the variety of surgical shock which we occasionally see following operations on the eyeball, the symptoms of which are "swimming in the head," thirst, and, before or after a drink, vomiting which may be accompanied by detachment of the choroid and intra-ocular bleeding. This form of shock is very like a sick headache, a hypodermic of morphia controls such shock if given early enough, when such patients complain of thirst, morphia controls the thirst. The patient should not get a drink to control this thirst, if he does, he will vomit to a certainty and with the strain of vomiting, the detachment of the choroid and the bleeding therefrom comes on.

(d) *Cataract complicated with general diseases*—This heading brings us to cataract in diabetes, cataract in Bright's disease and cataract in gout.

Cataract in the Diabetes of youth—Cataract in this form of diabetes is of the soft variety seen in children and young adults, not in my opinion soft in virtue of the fact that the patient suffers from diabetes but because the subjects are generally children and juveniles. It should be treated by the ordinary method of treating cataract in children—*vide* the treatment of cataract in children.

Cataract in the Diabetes of later life—The commonest variety of cataract in diabetes is seen in the diabetes of

later life In the tropics, this form of diabetes is often associated with gout in people who are corpulent or corpulent rather than spare

These cases do not waste from the disease, but with a little treatment seem to go on to an old age and to do their usual work very well In these latter cases and in gout the surgeon may extract cataract with the prospect that they will do practically as well as ordinary cases, and should be done by the intracapsular or by the capsulotomy method At the same time the operator should not lose sight of these patients for at least three weeks after operation, as they are more or less subject to post-operative glaucoma, however normal their eye may have appeared at the time of operation This condition sets in about ten days after operation, and if not promptly dealt with, it will rapidly destroy the eye For its treatment *vide* the chapter on the treatment of after-complications of cataract operations

The above varieties of cataract should not be termed diabetic cataract or gouty cataract in my opinion, as in my observation they are no more frequent than in people not suffering from those diseases

Cataract in Bright's disease—Cataract in Bright's disease is in my observation no commoner than in the same class of patients who do not suffer from albuminuria

They are suitable for either operation, they do just as well as ordinary cases except that they too are more or less subject to post-operative glaucoma

In all these varieties of cataract complicated with general diseases, it is important that the patient should have a few days of preparatory treatment as far as the general disease is concerned, and that throughout convalescence his dieting should be carefully looked after and his bowels kept regular

(e) *Cortical Cataract*—*Cataract complicated with disease of the Retina and Choroid*—Cortical cataract occurs chiefly in eyes which suffer from disease of the retina and choroid such as choroiditis, and progressive retinal atrophy whose symptom is night-blindness, though cataract occurs in these

diseases which is not of the cortical variety. Cortical cataracts are slow in maturing, cortical cataract is visible with the ophthalmoscope as a stellate opacity in the anterior or in the posterior portion of the cortex or in both. They should be extracted by either operation provided that glaucoma is absent and that the reaction of the pupil to light and that the perception of light indicate that we may hope to improve vision.

These cases, as far as the cataract operation is concerned, do as well as ordinary cases, and the operator need not be afraid of them. He may by extraction give the patient several years of useful vision, but he need not expect to stop the slow progress of the disease of the fundus in the case of night-blindness—progressive retinal atrophy.

(f) *Cataract in Irido-cyclitis*—When these cases come to us, they are generally hopeless, the eye is generally stone-blind. If the irido-cyclitis be acute, there is some hope of curing it. If it be cured leaving useful visual function in the retina, the lens may be extracted with an iridectomy by either operation, taking care to look out for a recurrence of the irido-cyclitis after operation.

(g) *Couched Lens*—The lens may be dislocated by injury or by nature, in which cases it is generally a partial dislocation.

The lens commonly said to be dislocated by nature is the hypermature lens. In my experience, as I have already pointed out, the hypermature lens is never dislocated by nature. It is the most difficult of all lenses to dislocate in extraction in the capsule. This confusion arises in my opinion from the fact that the capsule of this lens being so tough and dense it is dislocated in the act of lacerating its capsule in the capsulotomy operation, and that the operator confuses this with a dislocation by nature. The dislocated lens which I very frequently come across is the lens couched by the professional lens coucher. When he only partially couches the lens—a frequent occurrence with him—it later on floats up again behind the pupil on the hinge left and the

patient goes to the surgeon to have it removed. All these cases are easily recognised, the surgeon should get the patient to repeatedly close and open his eyelids, or should artificially do this for him when the lens and often the iris will be seen to tremble. These cases should always be extracted in their capsule if the perception of light and the reaction of the pupil to light is good enough to indicate useful vision in the fundus. If they are of long standing in the dislocated condition, simple atrophy of the retina invariably sets in—*retinitis pigmentosa sine pigmento*—with its symptom of progressive hemeralopia, still the lens should be extracted if there remains useful visual function in the retina.

This progressive atrophy does not occur in cases of trifling detachment of the suspensory ligament from the lens, in which the lens is not dislocated backwards. Fluidity of the vitreous in the cases dislocated by art, progresses *pari passu* with the progress of the hemeralopia, and the degree of the hemeralopia and of the retinal atrophy on which it depends are accurately diagnosed by the degree of sluggishness of the reaction of the pupil to light. The operator need not fear the vitreous being somewhat fluid. These cases do well as far as the operation is concerned. For the details of how to extract these lenses, *vide* the chapter on extraction of cataract in the capsule.

Dislocation of the lens in the anterior chamber is a rare thing even in dislocated lenses. These cases are at once evident to the eye, and should be removed without delay. They produce much more mischief than lenses dislocated behind the iris.

They cause opacity of the cornea against which they rest, iritis or irido-cyclitis and increase of tension and may even affect the other eye.

CHAPTER II.

COUCHING OF THE CATARACTOUS LENS.

THIS operation is, as far as I know, immemorial in the East. Whether it originated in India or in China, it would be difficult to say. I think the presumption is reasonable that the East gave this operation to the West, the operation which held the field in the West until comparatively recently. In India it is extensively practised at the present time by a caste known in the Punjab as *Rawals* and by other terms elsewhere. I know of three 'Rawals' from the Jullundur district of the Punjab, at the present time practising the art, among other things ophthalmic in Europe, one in Hull, one in Manchester, and one—itinerant—in Italy and Austria, and from a financial point of view they are undoubtedly doing well. These people are the immemorial specialists of India, in the Punjab they confine themselves to diseases of the eye and their knowledge is chiefly confined to the couching of the cataractous lens. Their knowledge of other diseases of the eye is practically *nil*.

I asked one of the most distinguished of the Rawals in this district to demonstrate to me on a *post-mortem* subject how he performed the operation.

At the present time he uses cocaine in powder, he used no antiseptic nor aseptic precautions more than to clean his probe and lancet with a piece of more or less dirty rag. He uses a sort of speculum, a catch forceps, a bleeding lancet and a probe with a triangular point, identical with the probe in an ordinary surgeon's pocket dressing case, and of about the same calibre or a little coarser. He makes a lancet puncture through the cornea near the scleral margin below, sufficient to easily admit the probe. He inserts the probe, drives it across in front of the iris of that side and beneath

the iris of the opposite side of the pupil, taking care not to injure the lens in doing so until the point of it has reached the opposite coats of the eyeball. He then elevates the free end of the probe the cornea acting as the fulcrum, thus depressing the lens behind the iris below. He then makes a special sweep with the point of the probe round each side to make sure of having detached the lens as completely as possible from its suspensory ligament. This completes the operation. The immediate result as far as the patient is concerned is magical. He can see. He has no pain. He has to all appearance no wound. He gets no dressing and is not laid up in bed. If all goes well, the result from an æsthetic point of view cannot be equalled by any modern procedure. I have probably seen as much of the immediate and remote results of this operation as any other man in the East.

In the first place, a large proportion of the eyes thus operated on are complete failures from sepsis as would be expected. A certain proportion of the remainder are complete failures from the bursting of the lens capsule with the probe, as an accident of the operation which results in iritis and irido-cyclitis followed by the usual atrophy of the bulb. In a certain proportion in which there is no injury to the lens capsule, irido-cyclitis and atrophy of the bulb follow, apparently from the lens acting as a foreign body. In the cases in which the lens makes its way in front of the iris, irido-cyclitis generally follows. The object of the operator is to completely dislocate the lens, but he very frequently fails to do so, and the lens in many cases floats up again into its original position behind the pupil, the undetached portion of the suspensory ligament acting as a hinge.

It will thus be seen that to couch the cataractous lens properly is one of the most highly technical operations in the whole range of ophthalmic surgery, and not the simple thing that it is usually regarded.

My experience in extracting such lenses when they float up behind the pupil, is extensive. Before making the corneal incision they tremble behind the pupil, once the incision is made,

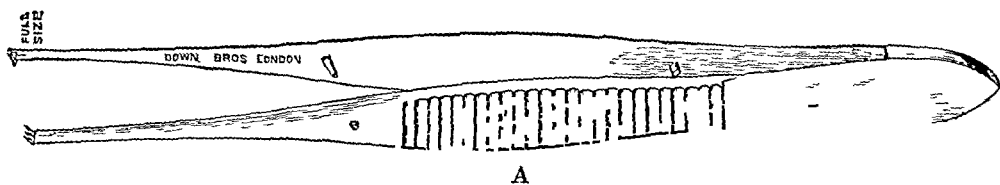
they float up tight against the pupil. They are in their capsule, they generally consist of the nucleus in the capsule, the soft matter having been largely absorbed, and hence they are generally small. They are quite easily extracted, their dislocation being almost complete, the remaining tag of suspensory ligament offers practically no resistance. The escape of vitreous occasionally occurs in these cases, but considering the circumstances, this is astonishingly seldom.

I always extract these lenses if there is any prospect of obtaining useful vision as indicated by the reaction of the pupil to light, as the result is as good as could be expected when the condition of the retina is taken into consideration. The invariable sequence in the successful cases of lens couching is atrophy of the retina indistinguishable in every way from that seen in *retinitis pigmentosa sine pigmento* except that its progress is much more rapid, so that an average of four years' 'useful day vision' in the most successful cases in my observation would be about the outside we could expect. It is rare to see one of them with 'useful day vision' of seven years' standing, though the eye looks normal to the naked eye except for its tremulous and sluggish iris.

From my experience in extracting couched lenses I infer that the life of the retina depends on the smallness of the nucleus of the lens, the soft matter of the lens becomes absorbed leaving the nucleus in its original capsule. The vitreous seems to progress in fluidity *pari passu* with the progress of the degeneration of the retina. The couched lens does not become fixed by inflammatory material as stated by Fuchs. I have never seen a single instance of such and my figures are large enough on which to base a sound generalization.

This chapter is based on careful and extensive observation. Statistics I do not produce. They would have no meaning as many of the Rawal's best results and many of his worst results I do not see. From the nature of the case the facts for statistical accuracy are not available. One thing I am dogmatic on, that is—that atrophy of the retina,

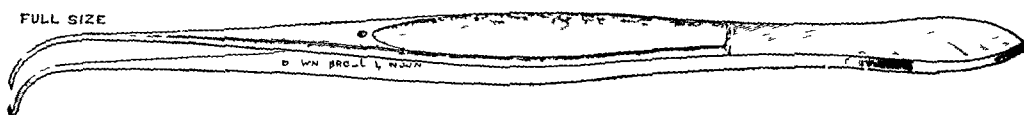
follows the couching of the lens in the most successful cases, and that the slowness of its progress in these cases depends on the rapidity of the absorption of the soft matter of the lens and on the degree to which the lens is so absorbed, as indicated by the size of the nucleus. The nucleus and the capsule are never absorbed, hence a scientific lens coucher would as carefully as possible diagnose the size of the nucleus of the lens, and, according to the size of the nucleus, he would base his prognosis of the endurance of useful vision to be expected.



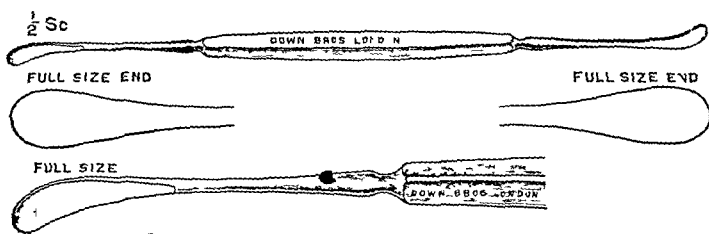
A



B

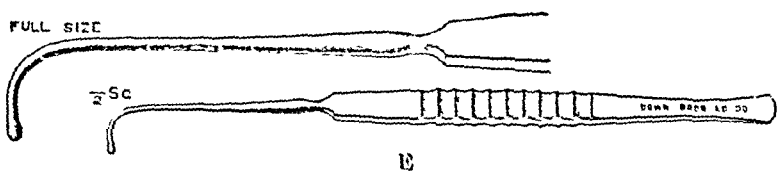


C

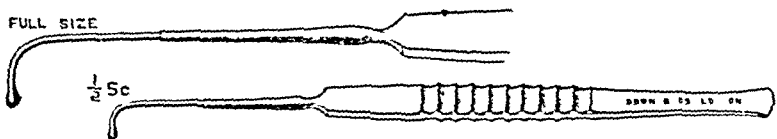


D

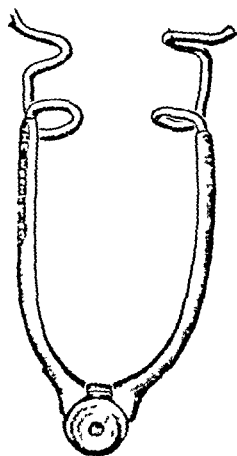
A — Catch Forceps B — Ius Repositor C — Ius Forceps D — Spatula



E



F



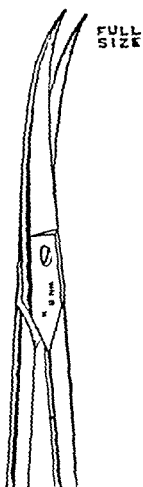
G



H



I



J

E — Lid Hook F — Lens Hook G — Speculum H — Graefe's Knife
I — Iris Scissors J — Capsulotome

CHAPTER III.

EXTRACTION OF CATARACT.

Daviel's operation

THIS is the operation which at the present time is generally practised outside India and to a large extent in India itself. It is the operation taught at medical schools and the one which occupies most of the space in the chapters on the treatment of cataract in books on ophthalmology. *Daviel about 1750 was the first man to deliberately make an incision in the cornea, scratch the capsule and squeeze out its contents, as a systematic operation, hence I term it Daviel's operation as he was the man who set ophthalmologists to think on this matter. He and, it appears, others had previously extracted the couched lens in its capsule which had made its way between the iris and the cornea—a region in which it sets up much mischief. From my experience of the work of the lens coucher in the Punjab where he practises couching of the cataractous lens to a considerable extent, even at the present time, I am of opinion that then experience in Europe of extracting the couched lens, which had made its way between the iris and the cornea, must have been of an exceedingly limited nature as it is exceedingly rare for the couched lens to make its way in front of the iris, and as it is so seldom seen in this position in India, where the work of the lens coucher is so abundant, it must have been infinitely less common in Europe, where cataract is relatively speaking rare. Couching of the lens held the whole field up to 1750, and indeed to a very large extent up to comparatively recent years. Various modifications of Daviel's operation have been made since his time, but when minutely examined, they are of a trifling nature. They consist in using different forms of knife, different forms of instruments—instruments for

* *Vide* Memoirs of The Royal Academy of Surgery, I, Tome, II Paris, 1753, p 357

cataract are legion, they are devised to a large extent to compensate for the lack of skill in the operator—varying the position of the incision, lacerating the capsule vertically or transversely or both, and to lifting a piece out of the anterior portion of the capsule. All these methods of opening the capsule were designed to lessen the density of the after-cataract.

McKeown, a man of genius in other respects as well as in this, introduced the method of washing out of the soft matter of the lens after extraction of the nucleus with a douche. How trifling are all these modifications of Daviel's procedure can be seen from the fact that there is not a single one of them universally adopted by operators of experience. Some adopt one modification and reject the others, and so on, and all seem to arrive at much the same conclusion as regards results. The douche has its advocates among experienced operators, many experienced operators, however, I think the majority, see no advantage in it. It is thus on its trial, and time will tell whether it too will live. This operation and all its modifications, deliberately aim at extracting the contents of the capsule and leaving the capsule or most of it behind.

This operation received its great stimulus from the observations of Pasteur and Tindal, introduced into practical surgery by Lister and the natural sequence of the threshing out of the bye-ways in theory and in practice of those observations, until we have now reached far towards perfection in asepsis, and from the introduction of cocaine. The results of this operation in pre-Listerian days would be to us of to-day appalling. Cocaine did away with the dangers and complications following intra-ocular operations under general anæsthesia.

Is the case operable?

The question as to whether a given case is operable or not has to be decided from three standpoints first, the condition of the lens itself, second, the general health of the patient, third, the condition of the eye and its surroundings.

(1) If the lens be immature, it is not suitable for this

operation as it is exceedingly difficult in such cases to get the last traces of lens matter detached from the capsule, and what is left swells up and is very often the cause of a severe iritis, which together with the capsule left behind and the proliferation of the cells of its anterior portion form a dense after-cataract for which a mere needling operation is not sufficient, as such dense after-cataracts, even after needling, have a great tendency to contract and to act as an irritant in the interior of the eye, setting up objectionable inflammation on the slightest provocation

(2) *The general health of the patient*—Diseases of the chest, Bright's disease, diabetes of middle and advanced life, gout, arterio-sclerosis, and the general condition of free drinkers of alcoholic liquids influence the result of cataract operations very little, and are no bar to operation provided that the patient has prospectively such a lease of life as renders it worth while to operate on his cataract. At the same time his condition should be recognized and treated so as to get him into as good general health as circumstances admit of before operation. After operation he should be allowed to sit up as early as possible as nothing upsets these patients so much as confining them to bed. Among other things before operation a mild mercurial purge followed by a mild saline appears to have a better effect on them than any other form of purgative. My experience is that blue pill (Pil Hydrarg B P) is the best of the mercurials for this purpose. His diet for several days after operation should be of the mildest variety—personally I prefer a diet of rice and milk, a rice diet being one of the finest of diuretics. In all these conditions the patients are very subject to post-operative shock and general nervous depression, occasionally delirium—all or any of which the operator should anticipate by having the patient well under the influence of a sedative at the time of operation. Of the sedatives for this purpose thirty to forty grains of Bromide of Potassium, administered at least two hours beforehand, is

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probably the best, five to ten grains of Bromural is fairly efficient, but its effects are rather evanescent, two to five grains of Veronal is possibly as efficient as Bromide of Potash, it certainly comes next, its action is sure, powerful and unaccompanied by untoward complications, if given in a hot fluid. The patient should be well under its influence in half an hour. Whatever sedative is used should be repeated from time to time as occasion may require, bearing in mind that if there be anything approaching to pain about the eye, the sedatives will act more promptly and more efficiently if a few leeches be applied to the temple (Leeches need never be feared, they never do any harm and they relieve pain connected with the eye in a manner which is almost magical in its quickness). In these cases, detachment of the choroid may occur immediately after operation with very free and very prolonged hæmorrhage. This is a comparatively rare accident, but apart from glaucomatic cases, this is the variety in which the operator would do well to anticipate it by administering a sedative as abovementioned before operation. After operation if the patient complains of headache, swimming in the head or thirst, the operator would do well to administer without delay a hypodermic of morphia which controls these conditions at once. They are the symptoms of shock, and if not promptly treated, the patient will vomit, the result of which may be detachment of the choroid. Again, this class of cases should not be lost sight of for at least three weeks after operation as it is in them that the comparatively rare complication of post-operative glaucoma is likely to occur. It usually sets in from about the 10th to the 15th day after operation.

(3) As regards the condition of the eye itself and its surroundings, the operator should be careful to look out for glaucoma, and to treat it according to the instructions laid down in the first chapter. Concerning the diagnosis of cataract and the operation to which it is suited, I have dealt with this subject in detail in the first chapter.

Any ophthalmia or tinea tarsi should be treated by the recognised methods before proceeding to operate. Disease of the lachrymal passages should be treated before operation, if necessary, by ablation of the lachrymal sac. Acute disease of the nose or throat should be treated before operation. Chronic diseased conditions of the nose or throat in my experience do not influence the result of cataract operations much. It is often impossible to cure those conditions though they may be somewhat improved, hence cataract in those conditions may be considered operable provided antiseptic measures be adopted to reduce the number of micro-organisms present for the time being.

Preparation of the Patient —If the patient be otherwise in good health, and if his bowels be regular, the less general preparation he gets, mental or physical, the better. He should not be introduced to a hospital atmosphere until after he is operated on. The pain and inconvenience of the operation should be practically *nil*. If put under mental and physical preparation for days beforehand, he will have 'died many times before his time,' and if he were consulted after operation on his experience, he would say that he expected a trying ordeal, whereas in reality it was almost nothing. If he be constipated, he should have a dose of castor oil or, what I prefer, five grains of blue pill at night followed by a seidlitz powder the next morning, the operator taking care that the effects of the purgative on the bowels is completed before operation. The preparatory mental training which so many recommend for the purpose of getting the patient to move his eye about as the operator wishes is not necessary and in most of my patients would be utterly futile. It is ineffective, it makes the patient nervous, the result of which is that he behaves much worse than if he had not been spoken to on the subject, the nervous patient always moves his eye into the position of rest or sleep. The operator should take his patient as quietly as possible and ask no favours of him, but proceed to operate in whatever position the eye happens to

assume The more he talks to the patient, the more nervous he makes him, and the more unintentional trouble he will give him If the operator lets the patient feel either by his language or by his acts that he has lost his temper or that he has got 'nerves,' he will beyond doubt become nervous, and why should he not? The ideal operator is the man who possesses no 'nerves,' who possesses no 'temper' as far as his patient is concerned, and who does not lose his temper with his assistants while operating This applies much more to operations on the eye than on other regions of the body, considering that the patient is quite conscious of what is going on and knows or thinks that the slightest wrong touch may render him blind for life The instruments required for this operation are a speculum, a pair of toothed forceps, a Graefe's knife, a pair of iris forceps, a pair of scissors, a capsulotome, spoon or curette of some sort (Daviel's for example), a pair of large-sized strabismus hooks, McKeown's douche if the operator wishes to use irrigation As regards the instruments and handles, the operator will find an ivory or imitation ivory handle for the knife more convenient than a metallic one, the reason being that the handle is small and that when wet, metallic handles are more slippery than ivory This, of course, may modify the operator's method of sterilization as ivory and imitation ivory do not stand heat, and in my experience the edge of a Graefe's knife does not stand heat, whether moist or dry, without becoming damaged, metallic handles are good enough for all the other instruments required In my practice, the knives are steeped for half an hour before commencing in a one in twenty (1 in 20) solution of carbolic acid, not only for cataract but for all ophthalmic operations, and if by any chance the instrument becomes suspicious, it is dipped in a bottle of pure carbolic acid for a few seconds and washed out in boracic solution Just before being used the rest of the instruments are sterilized by boiling As regards the instruments, the speculum should be of the spring variety without any screw or fixing mechanism The

joint should be so made that it cannot open beyond a certain point, which point allows room for any ophthalmic operation. The spring should not be too strong, the usual speculum sold by instrument makers has got a screw stop. The objection to this is that occasions arise when the operator may wish to take out the speculum with the minimum of delay, and with the screw speculum he cannot do this rapidly. If the spring be too strong, it keeps open the eyelids with unnecessary force, and causes inconvenience to the patient, the result of which is straining, also when the incision is made if the spring be strong and the patient strains with the orbicularis muscle, it gives him much more power to put pressure on the eyeball than if the spring were weak. In the latter case the speculum would either close up or be shot out of the eye, so that thus he could not have the same *point d'appui* for pressure with a weak spring that he would have with a strong one. The occasions when the operator may have to snap out the speculum are sudden straining immediately on completion of the incision or at any stage thereafter which would facilitate the sudden expulsion of the lens or some vitreous or both.

The speculum figured on the page of instruments at the beginning of this chapter is the one I find most enduring and most convenient. It is obtainable from Messrs Down Brothers, London. For this operation the operator will find it far more convenient in all cases in which the patient is not very troublesome to complete the operation with the speculum in position than with retractors. With retractors the cornea falls back and the eye becomes flaccid, and it is thus difficult to get the lens matter out, whereas with the speculum in position, the pressure of the lids through it keeps up such tension on the eyeball as is not dangerous on the one hand, and on the other hand, such pressure as keeps the lens forward and thus renders the evacuation of the cataract an easy matter. Retractors should be reserved for intractable patients. The *toothed forceps* (the diagram of which is on the page of instruments) should not be of the usual

pattern, they are usually made with a fixation catch, if they are otherwise right, the catch should be taken out of them. They should have two teeth in one jaw and three in the other. The type usually sold has got one tooth less in each jaw and it takes so small a grip of the conjunctiva that it is very liable to tear it. A catch in these forceps serves no useful purpose, and when the operator occasionally requires to let go his grip at short notice, he very often finds that the catch will not let go for him as rapidly or as easily as he wishes. As a matter of fact, the hand holding the forceps while making the incision should let go its grip the instant the incision is completed; if not, it is a further *point d'appui* for an obstreperous patient to use for straining against, the result of which may be that he may shoot out the lens and some vitreous.

The Graefe's knife should be more spear-pointed than they are usually made, that is, the point of the new knife should be more like the point of the knife which has been a few times sharpened, thinner and with the back and front of the blade forming a more acute angle than new knives usually have. The point is or should be used for puncturing only. I will shew later on how to use the knife, so that the operator need not fear a thin or fine knife. The objection usually raised against a thin knife is by men who do not know how to use it. A thin old knife will do twice as much work as a new one. I personally prefer it, as it does its work more satisfactorily. I often do over a hundred cataracts with a knife without re-sharpening which Weiss who has just sharpened them, labels 'dangerous'. Any form of *iris forceps* curved on edge is good enough, straight iris forceps are occasionally difficult to use in certain positions of the eye. The spoon or curette—Daviel's—should be thin, of plated brass and rigid in the shank. It should be shallow and not sharp on the margin. It should be rigid in the shank as it may have to be used for the purpose of pressure or counter-pressure, all the elasticity should be in the operator's hands and none in the pressure making instruments.

The strabismus hook—Is the size and shape I prefer, made of any rigid metal. It will be observed that it is ball-pointed rather than sharp, its point being used for replacing the iris and in the following chapter on extraction of the capsule, its point is used to a considerable extent for making pressure on the eyeball. This hook is about the most convenient thing for pressing out the lens in either operation, the convexity of the curve being used for this purpose in the capsulotomy operation.

The *capsulotome* should be bent in the shank to facilitate its use over the brow. There is no need for a right and a left-handed one. The capsulotome with the cutting spur at right angles to the shank, I prefer. The operator should see that its cutting spur is really sharp, as with a blunt one he is liable to dislocate the lens in the act of lacerating its capsule. If his capsulotome be not sharp, or if the lens be hypermature, he would do well to draw the point of the Graefe's knife across the capsule instead of the capsulotome. If such were the practice we would hear less of hypermature lenses dislocated by nature. The *scissors* should be of the ordinary iris pattern curved on the flat never on the edge, *straight* scissors are occasionally inconvenient. DeWecker's scissors (forceps) and some of the other ingenious devices in the form of scissors are not only unnecessary but they are difficult to keep in good cutting order and are expensive and do not do their work as well as an ordinary pair of curved scissors. While doing an iridectomy if the practice were for the operator's assistant to steady the eye with a toothed forceps, we would hear little of these ingenious devices, they would be unnecessary. Besides it is in the interests of the patient for the eye to be fixed by an assistant when a piece of iris is being excised as the patient often winces and moves his eye about when the operator catches the iris especially if the operator be heavy in the hands, the result of which is that the iris thus dragged upon bleeds freely when cut and is occasionally completely detached by a violent sweep of a patient's eye. The patient

can do no harm if the eye be fixed and it is much more convenient for the operator.

McKeown's douche — The most convenient form consists of a glass reservoir suspended a few feet above the table, capable of being readily raised and lowered when required, and to which a rubber tube of sufficient length is attached. To the other end of the rubber tube any of the nozzles is attached, a number of patterns of nozzles are purchasable from instrument makers, any one set of them is as good as any other. There is not so much in the particular pattern of nozzle as there is in the operator's lightness of hand.

The table should not be on castors as assistants are very liable to cause such a table to shift while the operator is at work. The head end of the table should have no cross stay which would come in the way of the operator's knees while operating, as he should sit with his legs right under the table.

The most convenient *stool* for the operator to sit on while operating is the ordinary dissecting room pattern. The stool should be so high that when the operator is sitting on it at the patient's head, he will be in no way inconvenienced. Its height will thus depend on the height of the table. The instruments should be in a flat dish on a small table convenient to the operator. The knife should be in a separate flat dish. As regards the preparation of the eye, much of what we see recommended is utterly unnecessary and is worrying to the patient. If the surgeon at his examination of the eye before deciding to operate be doubtful as to the healthiness or otherwise of the conjunctiva, he should order a pad to be placed over the eye at night and a bandage to be applied. If in the morning there be no discharge on the pad, the eye for all practical purposes may be considered fit for operation.

A good deal of interesting work has been recently done, by taking cultures from the conjunctival sac before operation, and some valuable facts have been brought to light, as to the relative importance of the various micro-organisms found in determining suppuration.

This method of examination requires to be carried out by a skilled bacteriologist and in practice, if the precaution be taken of using the pad described above as a guide in doubtful cases, is not necessary. Should any discharge be present, the appropriate treatment of the condition causing it should be carried out before the eye is operated upon. The operator should see by pressing on the lacrimal sac if the tear passages are normal and if normal, he is doing more harm than good by washing them out.

For this operation the eye should be atropinized at least three times, at intervals of not less than two hours during the preceding twenty-four hours beforehand, with a few drops of the ordinary liquor atropinæ sulph (B P), so that there should be no need for further atropinization for a few days after operation in caseitis follows.

When on the table the eye should be cocaineized by instilling a few drops of a 4 p c solution of cocaine into the conjunctival sac*. The skin of the eyelids and of their neighbourhood should be washed with a little ethereal soap solution and then with a 1 in 30 carbolic acid in water, or a 1 in 1,000 solution perchloride of mercury in water taking care that these solutions do not get into the conjunctival sac. This is quite sufficient for all practical purposes as far as cataract operations are concerned. The operator should now cut a few of the lashes of the temporal end of the upper lid to keep them from coming in contact with his knife. If one to two minutes have elapsed from the time of instilling the 4 p c cocaine solution, the eye is sufficiently anesthetised for operation. Weaker solutions of cocaine are not so satisfactory, cocaine is the best of the local anesthetics for ophthalmic work, cocaine, atropine and eserine solutions should be made up with distilled water containing 2 p c carbolic acid to prevent fermentation and if thus prepared seven days before use, they are safe for all practical purposes. Some patients are so troublesome that it is necessary to give them

* If the operator be not very experienced, he would be better advised to use 3 or 4 instillations at intervals of five minutes to secure more complete anesthesia. The above is my practice.

a few whiffs of chloroform in addition to the cocaine, just sufficient to take away the nervousness. There is no objection to this as with this amount of chloroform, they never vomit. Cases which need chloroform thus are rare.

The speculum should now be inserted. The operator should insert the finger or thumb as far into the orbit as convenient and grasp the orbicularis and eyebrow between the finger and thumb and lift them away from the eyeball at the same time lifting up the lids on the speculum, by which combined act, he will fully expose to the eye the whole of the conjunctival sac including the fornix which under the ordinary method is seldom flushed out. The assistant should now douche it out *well*. The douche reservoir should be five or six feet above the table and the connecting tube should have a nozzle of from $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, so that the douche will have some mechanical effect and will thus thoroughly flush out any foreign substance from the conjunctival sac, swabs are unnecessary. The solution in the douche reservoir may be either distilled water, normal saline solution, boracic acid solution or a perchloride of mercury solution up to one in two thousand. The one in two thousand perchloride of mercury solution is the one I personally use for this purpose, and I have never seen anything objectionable arising from its use. I would prefer distilled water or normal saline for this purpose, but the atmosphere of the Punjab is so loaded with septic dust that it is utterly impossible to keep the operating room reasonably free from it. To attempt aseptic surgery alone is hardly justifiable under such circumstances.

Ambidexterity —I have seen many ambidextrous men and I have never seen one whose two hands were equally good. The patient has certainly claim to the operator's best hand. In ophthalmic surgery no inconvenience arises from being merely monodextrous. Further, the maximum cunning which the hand can acquire depends on the extent of the experience which it can have, and there seems to be no limit to the degree to which its 'cunning' can be developed and no 'cunning'

of the hand can be too great for cataract operations. The view I advocate concerning the hand is exactly what Adam Smith advocates in "The Wealth of Nations" concerning the individual and illustrates by the art of pin-making. The hands of the operator stand in the same relation to one another as the individuals in pin-making. Each should be trained to do its special work, and if such be done, each will be trained to the highest possible degree of efficiency and will certainly acquire a much higher degree of efficiency than if each were used to cover the whole field, as in that case each hand would only have half the experience in any special act which it would have in the monodextrous, no one need expect that he will cultivate a really good "pair of hands" in a few days for any highly specialized art.

The operation —The eye being atropinized and cocainized, the speculum being inserted and the conjunctival sac being washed out, the operator sits at the head of the patient. Sitting is much better than standing, as the operator's hands are more steady and his back does not get tired. The patient is better without a pillow and lying flat than bolstered up, as his head is in a more convenient position for the operator. The practice of operating with the patient on a couch or in a chair is bad, he is in an inconvenient position for the operator and he is very much more liable to become faint in such positions than when lying flat on the table. The patient who becomes faint during or immediately after operation is liable to vomit and the consequence of the straining of vomiting may be detachment of the choroid with copious bleeding and immediate loss of the eye. Vomiting is the great precursor of detachment of the choroid, hence the importance of avoiding the use of general anæsthetics as much as possible. If the operator be not ambidextrous he should stand by the patient's side to make the incision in the left eye and sit for all else concerning that eye as well as for the other eye. He should grasp the conjunctiva with the toothed forceps as close to the cornea as possible as this is the fixed position of the

conjunctiva, and hence the eye cannot roll about. He should, if making an upper incision, catch the conjunctiva below and *vice versa*, or, in other words, he should catch it over a line let fall over the centre of the pupil and at right angles to the line which the knife is intended to follow. He should not trouble the patient by asking him to shift his eye downwards or in any way. He should draw the eye with the grip he has taken, in whatever direction he wants it. He should draw it and not press it with the end of his forceps. If he pulls it, the iris will not drop across the edge of his knife while making his incision. If he presses it with the end of his forceps, the iris will drop across the edge of the knife while making the incision. As regards the size of the incision the operator has never to regret making his incision a little too large. He always has reason to regret having made the incision too small. It is not always an easy thing to enlarge an incision which is too small. If it has to be enlarged, it should be done with a pair of small blunt pointed scissors, and while doing it, the assistant should lift the eyelids on the speculum and lift the orbicularis and brow as described for washing out the conjunctival sac, which takes the pressure off the eye and allows the iris to fall back out of his way. It is the iris being pushed forward in the way of the scissors, necessitating the disturbing of that sensitive structure with the scissors which causes the patients to wince and which constitutes the difficulty of enlarging an incision, only experience in diagnosing the size of the nucleus of the given lens in the given case will enable the operator to make what I term the 'economic' incision—that is, the incision which will just easily let out the nucleus, until that experience is acquired the operator is safe in making a standard incision of about $\frac{2}{5}$ th of the circumference of the sclero-cornea. He should insert his knife in the sclero-corneal junction or slightly more sclerotic than sclero-corneal and cause the point to make its exit through the opposite side at a similar depth. He should not bother with the usual instructions to direct the point of his knife towards the centre of the



Fig 6 The left hand figure shows the effect of passing the knife across the anterior chamber exactly flat. Note that it will emerge where the arrow points quite a distance from the corneal margin and back where the blood vessels lie. The right hand figure shows the effect of passing the knife across the anterior chamber turned with its back at an angle to the plane of the iris. The effect being to cut the cornea quite in its ueer and at nearly right angles to its structure. The blood vessels are not severed in this method

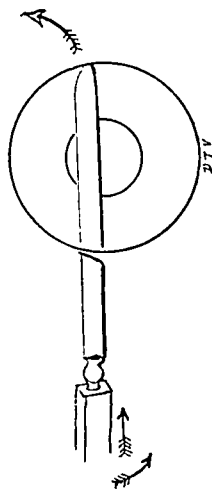


Fig 7 Showing the knife as the point disappears under the hilt in making the counter puncture. As soon as the point emerges the handle is lowered. The knife driven slowly forward and the blade made to pass over the bridge of the nose till it is in to the hilt after which the handle is elevated as shown in Fig 10

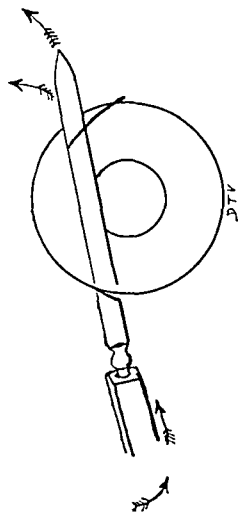


Fig 8 Showing how the knife is being driven forward as the handle is lowered and the point raised. Thus cutting upward on the nasal side of the cornea, at the same time allowing the blade to pass over the bridge of the nose. Note the directions to make the knife go as shown by the arrows

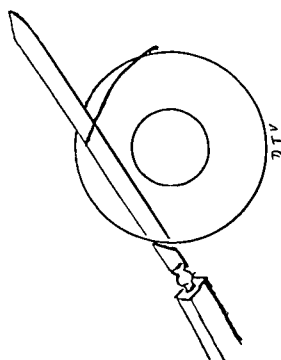


Fig 9 Showing how the nasal half of the corneal incision is completed by lowering the handle and pushing the blade over the bridge of the nose till it reaches the hilt The figure shows the stage when the section should be completed by raising the handle and drawing the cut—not sawing it

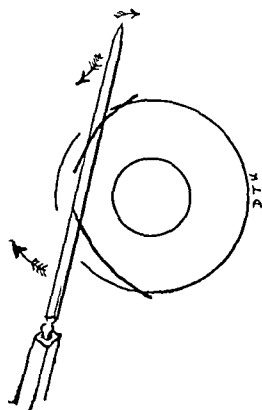


Fig 10 Showing how after the nasal half or more of the incision is made by the forward go of the knife The temple half or less is completed by raising the handle and drawing the knife back ward The arrows show the upward and backward direction the knife is describing and the edge of the knife is turned forward

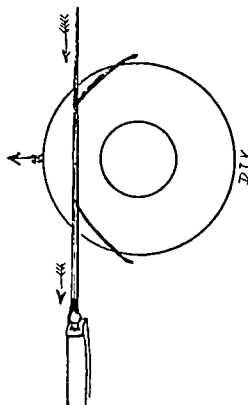


Fig 11 Showing how by turning the edge of the knife forward and drawing the blade back, at the same time cutting upward and out (see dotted line) The incision can be completed without slicing the 1119

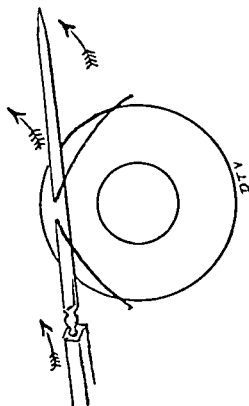


Fig 12 Showing how in some cases the incision can be made by a single forward thrust of the knife (no draw cut and no sawing cut). The arrows show the direction to make pressure in completing this cut. The edge of the knife is turned forward toward the cornea.

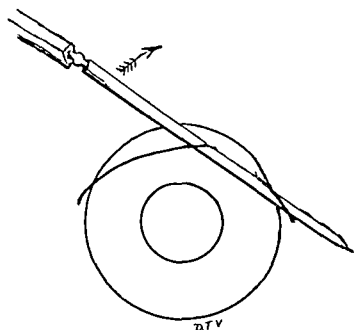


Fig 13 Showing how, in cases of deep set eyes, where it is impossible to pass the blade of the knife through to its hilt, the handle of the knife can be raised, the edge of the knife turned forward and the incision completed by a quadrangular sweep of the handle upward using the blade as a lever of the second class, the fulcrum corresponding to the nasal end of the wound. The arrow shows the direction to follow in completing this cut.

pupil when penetrating the proximal side of the sclero-cornea and then bring it straight This is an unnecessary refinement and has no meaning in practice He should enter the point of the knife perpendicular to the surface of the sclero-cornea and drive it straight across on the flat, and when the point touches the opposite side of the sclero-cornea, he should twist it slightly on its back, that is, at an angle of about 45° and drive it through When the point is through, he should again bring it on the flat, drawing the eye at the same time with the forceps to such a position that he can push it right through to the heel The point often reaches up over the bridge of the patient's nose, to allow it to do this, while drawing the eye in the direction he wants, the knife being through he should lean the handle down so that the point may go up over the nose There is no appreciable force required with either hand to do this, yet once done or seen done, its importance is appreciated by every one He should then complete his incision with a single draw cut backwards If he finishes the incision too rapidly, the iris gets caught in the wound and causes the patient to wince If he wishes to make a conjunctival flap, he requires to complete the incision in the sclero-cornea, if he does not wish to make a conjunctival flap I consider it much more preferable to complete the incision in the cornea The operator will know that he has made his incision too deep if the sclero-corneal wound bleeds This is different from conjunctival bleeding, the incised conjunctiva always bleeds If the sclero-corneal wound is not too deep it never bleeds in a sound eye Concerning the twisting of the knife on its back a little, when passing through the opposite side of the sclero-cornea, the object is to make the point come out exactly where we want it, which by adopting this manœuvre it will always do In the case of a thin pointed knife if pushed in on the flat through the opposite side of the sclero-cornea, the point generally follows somewhat round the sclerotic splitting it and comes out too deep which results in free bleeding from the circulus

irid vasculosi which has been wounded The thick pointed new knife does not do this, but it is not so good and it is not so pleasant to work with if the above manœuvre be adopted By using the knife as above described, the point is used for puncturing only and the body for cutting, and if carefully used thus a good knife will do in one, two, three or four days a hundred cataracts easily It is the point which fails first and by using it thus we give it the minimum of work to do The point of the knife is not made for cutting, though it is very common to see it used for cutting The whole act of making the incision is a single act and not a series of acts If the iris drops across the belly of the knife, the operator should turn its edge slightly forward so as to escape it and go on, the result of which is that he either escapes it or does the iridectomy at the same time Before entering his knife, the operator should always look at it, to see that the edge is in the right direction This may look unnecessary advice, but it is not The most careful of men occasionally discover that the edge of the knife is in the wrong direction when it is through the eye If such a thing does happen the knife should not be withdrawn but should be twisted over on its back—its back toward the lens—and the incision finished The only undesirable thing which usually results under these circumstances is that the iris comes over the edge of the knife and that the iridectomy is done at the same time

How to hold the knife and the forceps The importance of this should be self-evident, but when we see many operators at work, we see how little importance they attach to it in practice In the first place, both hands should be steadied by resting them on the head of the patient while making the incision The hands resting in the air can never be steady Resting the hands on the head not only render it possible for them to be steady but serve the important object of steadying the head of the patient Our Indian patients, when the knife is through or going through, often give their head a violent shake, and if the head be not between the operator's hands,

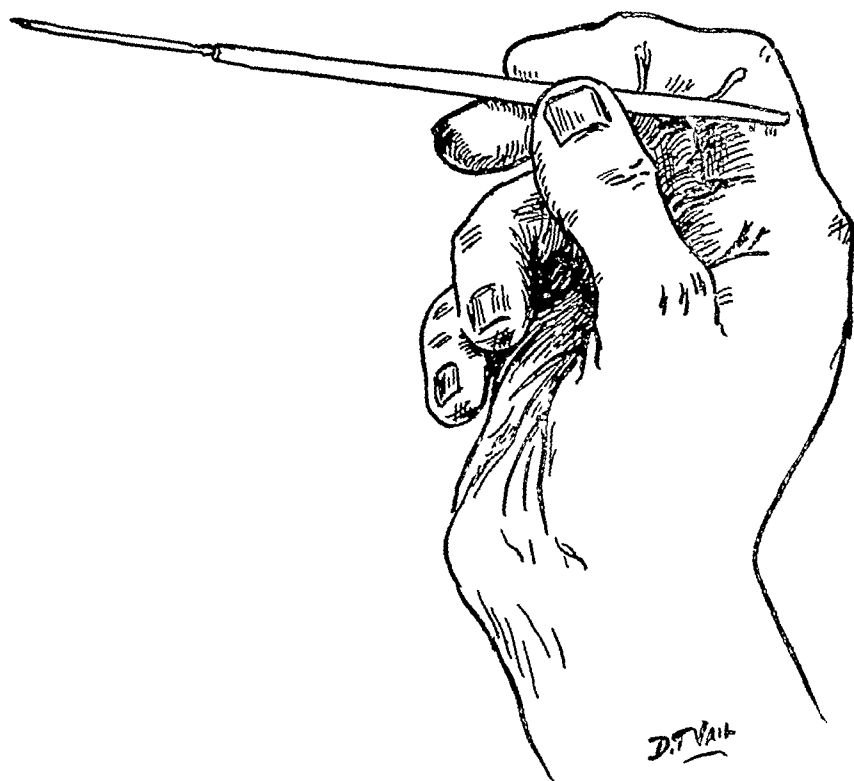


Fig 14 Showing the first position of the hand and proper hold on the knife a little back of the center of the handle and very lightly

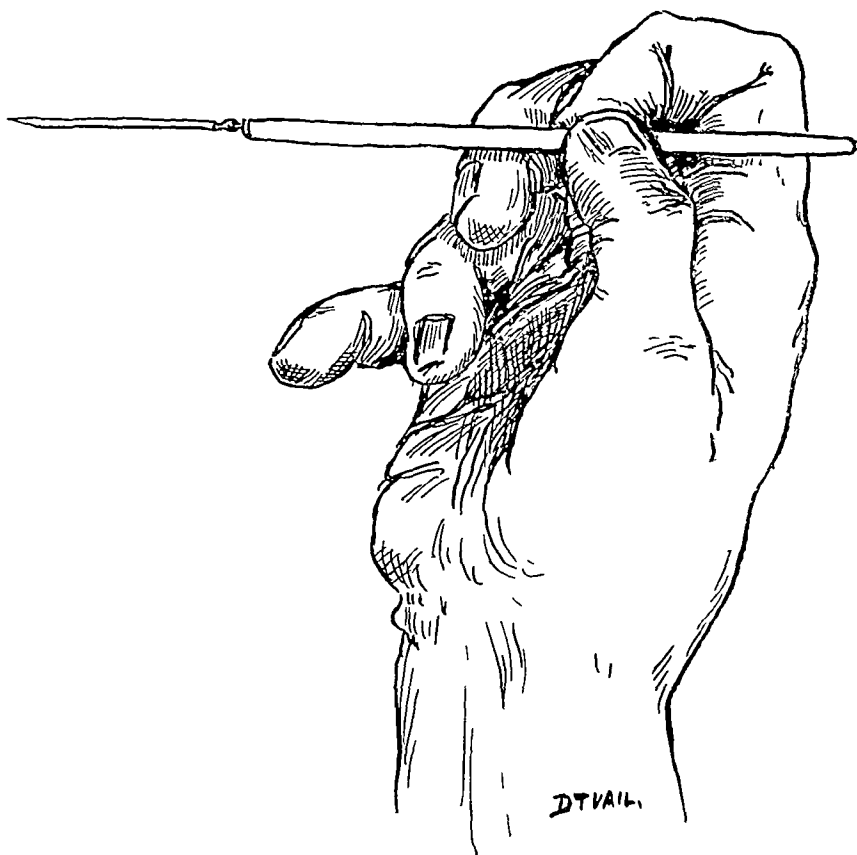


Fig 15 Showing the second position of the hand—the hand is steadier by the little finger on the temple or zygoma. The knife is drawn back by finger flexion, while the point is applied to the sclero corneal margin. The section is made by finger movements only.

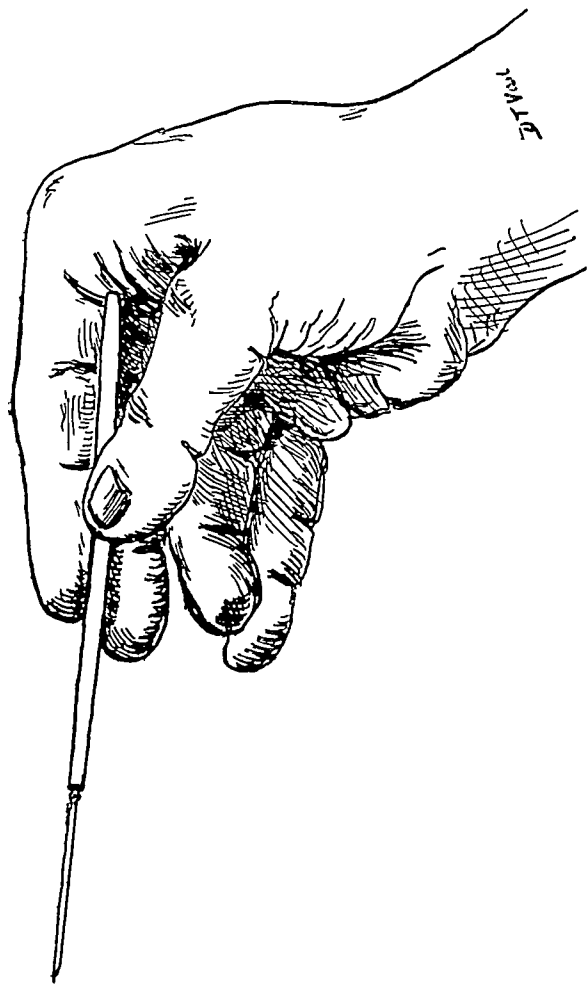


Fig. 16 Showing the third position of the hand in making the section. The fingers are straightened out. The knife held lightly. The position is favorable for lowering the handle and continuing the forward cut till the blade is through to the hilt, when by raising the handle the section is completed.

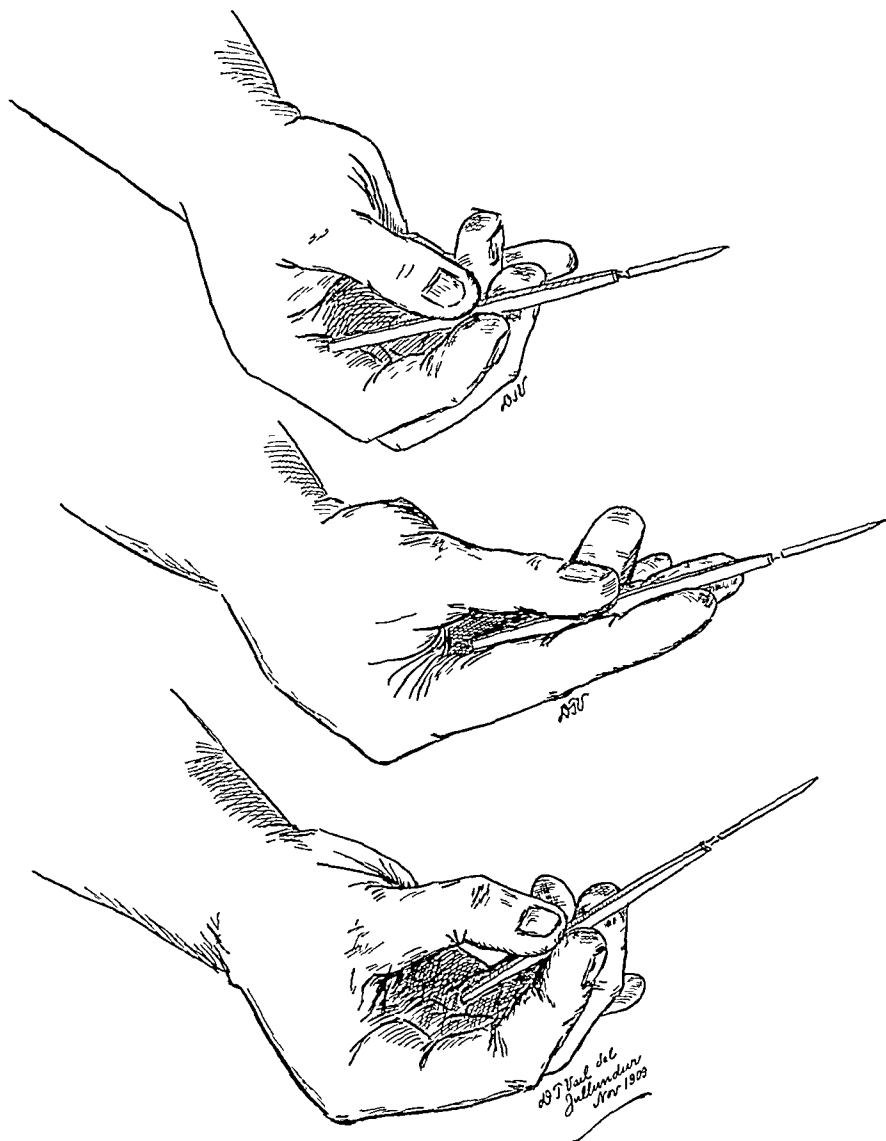


Fig 17 Showing the different positions the fingers assume in making the incision. The forearm, wrist and palm are held steadily in one position, while the fingers manipulate the knife on various angles to complete the incision. No sawing is used.

undesirable results may ensue therefrom. The patients in these cases almost always shake the head away from the knife.

How to hold the left hand on the head—I am speaking of right-handed and not ambidextrous people. In operations on the right eye, the operator should hold the toothed forceps as one holds a pen, the ring and little fingers should be flexed at the proximal pharyngeal joint on the palm, the ulnar border of the hand should be rested on the left cheek, the ulnar border of the little finger should be rested against the superior maxilla and the back of the little finger and of the ring finger should rest against the ala of the left side of the nose. By having the left hand in this position while holding the conjunctiva, it can serve the two purposes of being steady itself and of steadying the head of the patient if he misbehave.

In holding the knife for the same eye, he should catch it as one holds a pen in writing and hold it if anything more lightly. His hold of the knife should be fairly long, that is a good distance from the blade. The back of the terminal joints of the little finger should rest against the front of his temple and the ring finger should rest on the little finger and against the temple, the fingers and thumb holding the knife when in the straight position as a pen in the act of writing should now be drawn back without shifting back on the handle of the knife as far as convenient, so that they look in the position of a partially closed fist. In this position the point of the knife should be fairly near where it should enter—a thing determined by the distance from the blade to the operator's fingers holding the knife. The knife is now driven across to the heel by the straightening out of the fingers and thumb holding it to any degree necessary. The incision is completed by the flexing up of the fingers holding the knife, cutting out at the same time. It will thus be seen that when the knife is through to the heel, the incision should be finished by a single draw cut without any sawing. The fingers resting on the temple when the fingers holding the knife are

straightened out, may come on their ends, but they should never leave the temple until the incision is finished. By adopting this procedure, the hand will be as steady as it is possible for the hand of the particular individual to be. The head of the patient is thus fixed between the operator's two hands, and if it moves no harm results, as the operator's hands move with it. The instant the incision is completed, the left-hand grip of the conjunctiva should be let go.

If a troublesome patient at this juncture strains with the operator holding on to the conjunctiva, he will have more power than he otherwise would have to squeeze out the lens and the vitreous. The knife should be driven across invariably the depth above described, the different modern incisions differ merely in the position in which the incision is completed. Some complete it half way between the proximal border of the normal pupil and the sclero-corneal junction. Some complete it between the latter and the sclero-corneal junction and some complete it in the sclero-corneal junction. The first or second of the above-mentioned incisions, I think I am right in saying, most Indian operators ultimately adopt, the first, if no iridectomy is being done, and the second, if an iridectomy is being done. The object of cutting well forward in the cornea is to avoid incarceration of the iris in the wound in the non-iridectomy cases, which in my personal experience is less likely to occur with this incision than with any other. The second is the one I prefer when I do an iridectomy, the third is necessary if the operator wishes to make a conjunctival flap. If the operator is going to make a conjunctival flap, he should instil a few drops of 1 in 1000 adrenalin solution with or before the cocaine in order to reduce the hæmorrhage which always occurs from the conjunctival flap, otherwise adrenalin is not necessary in cataract operations. I have tried the conjunctival flap and have given it up. It is followed by much greater astigmatism than the incision ending in the cornea, *i e*, the incision approximating a radial incision. The bleeding from it is an objection, as

it prolongs the operation the hæmorrhage causing obscurity. It also has the objection that it is in the way, flapping about in the wound. The advocates of the conjunctival flap claim that it prevents down growth of epithelium which otherwise may occur. My own belief is that this down growth is a negligible quantity unless tags of capsule are lying between the flaps and thus prevent proper primary union.

The fact that in Daviel's operation tags of capsule very frequently make their way into the wound and thus form a drain which is very liable to become septic in the case of incisions finished in the cornea is the great argument in favour of the conjunctival flap as it rapidly shuts off such drain from the conjunctival sac.

An iridectomy or no iridectomy — Both these procedures have strong advocates. The advocates of the non-iridectomy or simple operation argue chiefly on æsthetic lines, cosmetic appearances. Undoubtedly the results are pretty in the cases in which the iris is not complicated with the wound. Everyone would do this simple operation were this complication not frequent. They also claim that the excess of light let in by the iridectomy causes confusion from a refraction point of view and that there is less risk of tags of capsule becoming implicated in the wound. The advocates of the iridectomy or combined operation claim utility as the advantage of their procedure, they claim that they are free from complications of the iris with the sclero-corneal wound and in consequence they have no after-trouble with prolapsed iris. This implies that they have not only not to deal with the prolapse, but also that they have not to deal with occluded pupils resulting therefrom, and that their cases are in consequence of not having these iris complications, less subject to sepsis. So far I agree with them, but they must admit that tags of capsule are more liable to become implicated in the sclero-corneal wound when an iridectomy has been done. Further they claim greater facility for removing lens matter in the combined operation. This implies that they get the lens matter more thoroughly removed than in the simple operation and con-

sequently that their cases are less subject to iritis. Many of the advocates of the simple operation say that this is not so, nevertheless in my experience which is liberal, I emphatically say that it is so. The advocates of the simple operation who admit this fact attribute this greater frequency of iritis in the simple operation to the greater bruising of the iris from the escaping lens. That this is not the cause of this iritis is demonstrated by extraction in the capsule, an operation rarely ever followed by iritis, though from the escape of the much larger body in the capsule bruising is necessarily much greater. The iritis following cataract extraction is almost always due to the combination of lens matter and capsule left behind. It is thus important that the minimum possible of lens matter should be left behind in this operation. The advocates of the combined operation argue that in practice the iridectomy being under the upper lid, it is not cognizable except to an expert as it is in practice covered by the upper lid, and that from a practical point of view, confusion, arising from excess of light thus, does not occur, and such is my observation. Further, if a little of the coloboma would normally be exposed, these patients instinctively allow the upper lid to drop slightly lower than normal, and thus shut off the excess of light. It will thus be seen that I am an advocate of the combined operation. If I had a cataract to be extracted from my own eye by any operation, I would have the combined operation done.

How to do the iridectomy — An assistant should hold the conjunctiva with the toothed forceps to steady the eye. It may look very dexterous to be able to dispense with an assistant while doing this iridectomy, but the iris being a very sensitive structure, if the patient is nervous he will roll his eye about the moment it is caught, or any patient, if the iris be pressed with the forceps, will roll his eye about. In either case a serious accident may occur. The accident may be the squeezing out of the lens and vitreous, or detachment either partial or complete of the iris. Besides, those who do an iridectomy in this operation without an

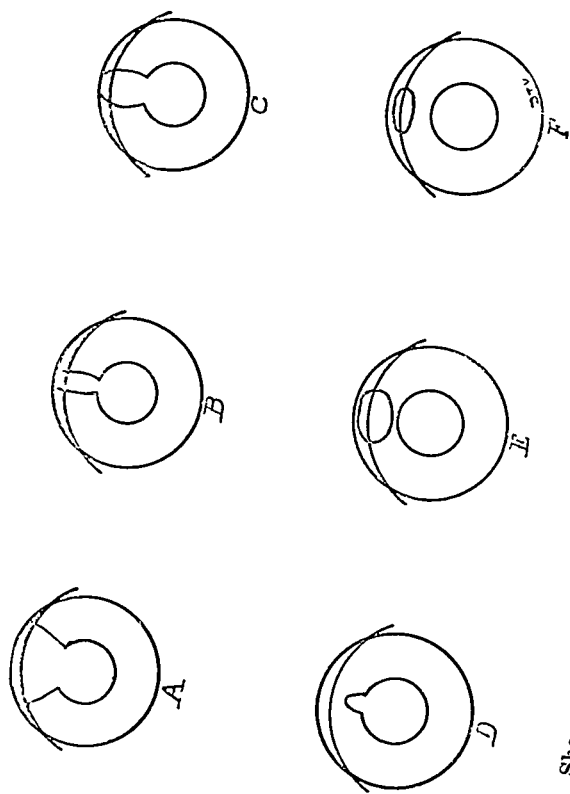


Fig 18 Showing different kinds of iridectomy A—Too wide B—Too narrow C—The proper one D—The sphincter only has been cut E—A large button hole at the pupil margin F—A small button hole at the pupil margin G—The lens passing through the pupil In E the thin bridge will separate as the result will be a round central pupil In some cases (near age of 50) the button hole shown in F is done intentionally and is a better operation than the simple extraction, as there is a hole for the aqueous to escape in case of sudden evacuation of the aqueous chamber during the healing stage, thus affording a reasonable insurance that the iris will not result in a button hole

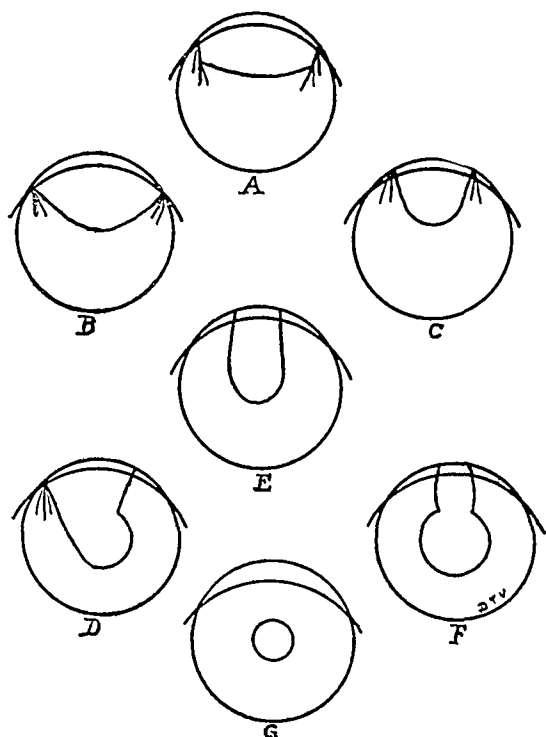


Fig 19 Showing different results as regards the shape and position of the pupil left after extraction, whether in the capsule or by the capsulotomy method A —Vitreous has escaped The angles of the coloboma are incarcerated in the wound or folded in such a way as to produce an unsightly drawn up pupil By timing off the vitreous while the upper lids held on the lid hook by the assistant and using the iris spatula properly as if nothing had happened, the curled angles of the coloboma can be unfolded and the pupil left in good position B —Shows a faulty result due to neglect of the operator to complete his operation by proper disentanglement of the iris incarcerations at the ends of the incision by means of the iris spatula C —Shows still another faulty position of the pupil due to the same cause as B D —Showing one arm of the cut iris properly replaced, but the other still hung in the wound E —Shows the effect of proper use of the iris spatula F —Shows a nice pupil properly replaced where a small iridectomy has been done G —Shows a round central pupil in a case of simple extraction

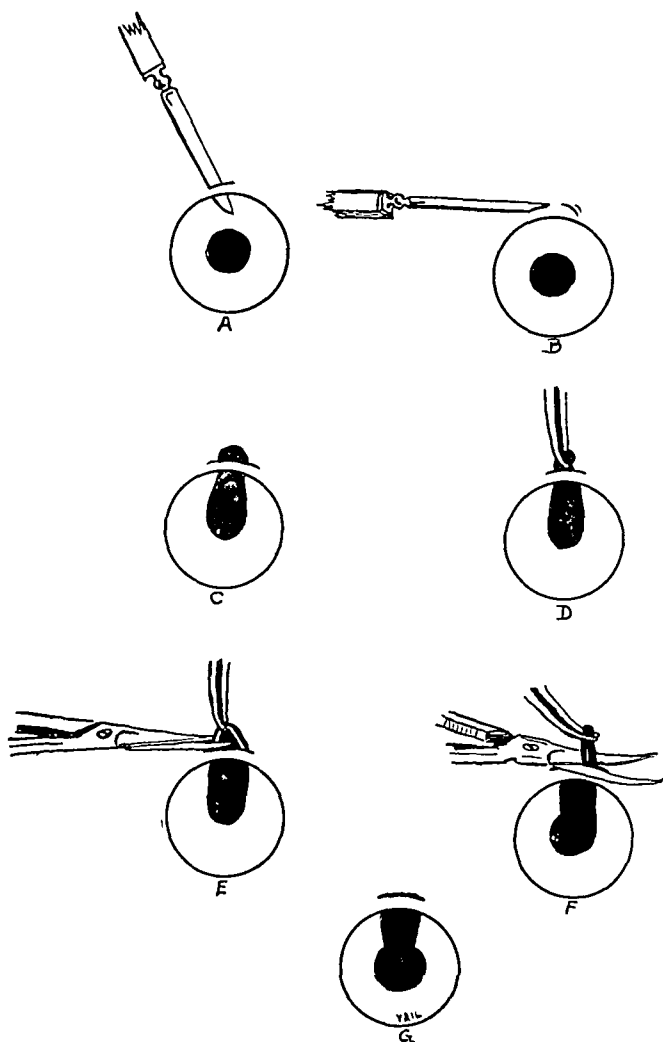


Fig 20 Illustrating the iridectomy for Glaucoma

A —The point of the knife is thrust through the sclerotic and emerges in the anterior chamber at the extreme angle
 B —The handle is then depressed to nearly right angles at the point, cuts its way out with a snap C —The iris protrudes by depressing the upper (sclerotic) wound causing a hernia D —The hernia is grasped by forceps E —The scissors cuts one side of the pupil margin to its periphery F —The scissors completes the iridectomy G —The result

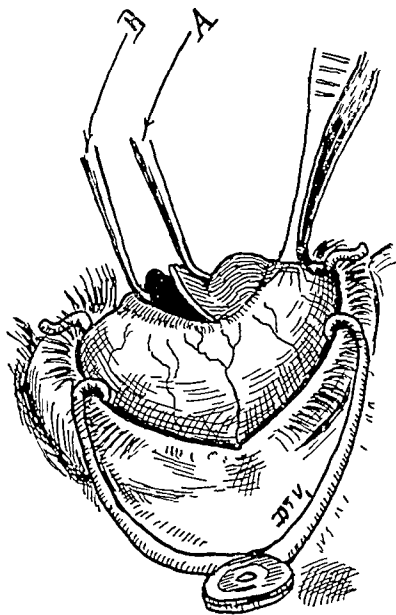


Fig 21 Showing the method of grasping the iris The end of one arm of the forceps is entered in the wound against the *scleral* side of the cut, while the end of the other arm of the forceps is made to glide over the cornea from the center upwards, at the same time depressing the cornea to force the iris up in the wound where it is seized and cut off The assistant steadies the eye with fixative forceps below The depression of the cornea is exaggerated in this sketch



Fig 22 Showing how the iridectomy is done after iris is grasped Note that the ring finger of the left hand is in perfect control of the eyebrow, also that the right-hand has perfect command of the scissors causing them to cut clean and sure The tip of the thumb and the tip of the ring finger of the right hand are inserted in the rings of the scissors

assistant, have to worry the patient to get him to hold his eye in position, and thus all things combined, they render him more nervous for the remainder of the operation than if an assistant had quietly steadied his eye. In the conjunctival flap operation, the iris forceps are passed in and the iris *very* lightly caught near its free border, drawn out and cut off. The amount cut off varies with the operator. It is not necessary to do a large iridotomy. Some advocate little more than an iridotomy which is not sound as the tails of the iris very often in this case become incarcerated in the sclero-corneal wound. The iridectomy thus should be of medium size so as to avoid this complication which is the chief reason for doing the iridectomy. In the non-conjunctival flap incision cases, the way to do it is to touch the posterior border of the wound with one jaw of the forceps, the other jaw should touch the cornea central to the position of the free border of the iris. He should now close the forceps by moving only the jaw which is over the cornea and pressing it down on the cornea. By this means the border of the iris is pressed out and lightly caught without inserting the forceps. This cannot be done in the conjunctival flap cases as the conjunctival flap is in the way. In cases in which the iris is adherent to the lens, the iris must be caught directly and torn off the lens. There need be no fear about tearing it off the lens as these adhesions are never firm and never give any trouble in the tearing off. The grasp of the iris should be very light in non-adherent cases, little more than touching it—it is a sticky membrane and adheres to the forceps. If caught thus, the patient will not be caused to wince. The cutting apparently causes no pain but pressing the iris with the forceps or dragging on it, or both, cause sharp pain. If the iris be dragged or get any rough treatment it will bleed when cut, but if not, and the eye be healthy, it does not bleed after an iridectomy.

Lacerating the capsule—One of the complications which follow the capsulotomy operation is incarceration of portions of the lacerated capsule in the wound. This is a very impor-

tant complication A tag of capsule incarcerated in the wound has a great tendency to behave after the manner of a foreign substance, preventing proper healing of the wound, and thus acting as a diain along which there is an entrance for septic organisms It renders the dealing with the after-cataract infinitely more difficult and more unsatisfactory than if it did not exist, hence the importance of dealing with the capsule so that this complication may not occur Some advocate lifting a piece out of the anterior portion of the capsule with a special forceps so as to leave the central portion of the after-cataract less opaque This has force if the operator does not intend to do an after-cataract operation, but an after-cataract operation is invariably necessary, sooner or later, if the patient is to have vision for fine work, hence the importance of this procedure is not as material as it is made to look There is the objection to this procedure that the operator is liable to dislocate the lens in doing it and in the case of hypermature lenses is almost certain to do so It will thus be seen that I advise one of the older fashions of opening the capsule, some advocate a transverse incision in the capsule and lay down that the portion next the wound is rolled out of the wound by the escaping lens and that it can thus be caught and torn off after the lens is out This looks all right from a mechanical point of view, but we are not to forget that the capsule in these cases almost always retracts from its elasticity or from the elasticity of its attachments In my experience, it is very seldom that it can be caught as the advocates of this procedure lay down, and if not caught and torn off, it is in the best possible position to become attached to the wound The laceration which I regard as the most satisfactory, is a laceration at right angles to the wound It serves all the objects required, and the tags of the capsule are not so likely to become incarcerated in the wound

Extraction of the lens —The operator should now with a Daviel's spoon in his lefthand press the upper lip of the wound lightly and at the same time with a strabismus hook

(before described) in his right-hand, place the convexity of its curve—not press with it on the flat—over the cornea near its lower part. This applies to upper incisions and *vice versa* for lower incisions. He should then apply steady, firm but not heavy pressure with it, and as the nucleus escapes, follow it up by a sliding movement of the hook on the cornea with exactly the same steady pressure. By this process he will drive out not only the nucleus but almost all the lens matter. If he slacks off the pressure with his right-hand instrument or intermits it before it has reached the lip of the wound, he will leave a mass of lens matter in the eye. After the nucleus is delivered, the sooner he lessens his pressure with the right-hand instrument, the more lens matter he will leave behind. This mass of lens matter is quite easily driven out with the lens if the above procedure be adopted. If this mass be left after the nucleus is out, it requires a considerable amount of massaging or douching to drive it out. In any case, some lens matter will remain behind after the first sweep of the right-hand instrument, however dexterously it may be used. It will thus be seen that the pressure applied with the left-hand instrument is slight and more for the purpose of steadying the eye than anything else. The advocates of McKeown's douche insert the nozzle and flush it out, the opponents of the douche massage it through the cornea, stroking it towards the centre of the pupil, so as to drive the remaining lens matter there and with a repetition of the original sweep of the right-hand instrument, they drive it out as much as possible. The uninitiated may think that this amount of massaging of the cornea must injure the cornea, but this is not so, the outer surface of the cornea tolerates a considerable amount of such massaging without showing any reaction. The inner surface of the cornea does not admit of being touched with instruments without showing inflammatory reaction, hence the importance of reducing instrumentation in the interior of the eye to the minimum possible.

This brings us to the use of the McKeown's douche. If the operator wishes to try it, it is important to recognize

that escape of vitreous is more often associated with its use than without it. This, many of its advocates admit.

The fluid used in this douche should be normal saline solution made with distilled water. After the nucleus and some lens matter have escaped the speculum should be allowed to remain in position—the conjunctiva should be caught with a toothed forceps so as to steady the eye with the operator's left-hand. The nozzle of the douche should now be inserted and shifted about round the interior of the capsule, so as to flush the lens matter from the periphery of its interior. It is important in the use of this instrument that the eye be fixed with the forceps as any movement of the patient's head or eye may drive the nozzle through the capsule and cause escape of vitreous. If this accident does occur, the operator should desist with the douche. When the lens nucleus and lens matter have been removed by either method, the lens matter in the conjunctival sac should be gently flooded out with the douche, the speculum should now be taken out and the upper lid lifted on a retractor (the strabismus hook in the instrument basin) and the lower lid drawn down by the face of the thumb of the assistant placed on the face below the lid, so as to take all pressure off the eye and thus render it easy to replace the iris. By this procedure the iris will often fall back into position of itself and the cornea will also fall back. If the iris does not fall back of itself, it should be replaced by drawing the ball point of the strabismus hook along it at each end of the incision close to the periphery of the iris. We thus replace the peripheral portion of the iris. The free border generally takes care of itself, if the periphery be replaced, the pupillary margin spontaneously resumes its normal position. If vitreous escapes, the vitreous hanging out of the wound should be snipped off with scissors as its stroma may act as a drain in the wound. The moment vitreous escapes, the speculum should be taken out as rapidly as possible and the assistant should take charge of the lids, the upper with a retractor and the lower with his thumb on the face to prevent further escape. After the

escape of vitreous, the less manipulation the better. The lids may now be let go, there is no need for any antiseptic powder in the eye or over the eyelids.

Dressing—If the margins of the eyelids be smeared with a little dilute yellow oxide of mercury ointment, the lids and lashes will not be found sticking together at the next dressing. The dressing should consist of a single layer of any of the antiseptic gauzes smeared with boracic ointment and a thin layer of coloured sterile absorbent wool or coloured antiseptic wool. It is important that the layer be thin, just so thin that when the bandage is applied it will cause no pressure on the eye and yet be sufficient to exclude light and atmospheric dust and germs. The slightest light which gets through the closed lids causes these patients inconvenience. The closed eyelids alone are not sufficient to exclude light, and coloured wool excludes it better than white wool. As regards the bandage, the most convenient is an ordinary bandage applied as a figure of eight. It has the merit of being simple and as it runs over the natural prominences of the face and forehead it has the advantage of being less liable to cause pressure on the eye than any of the ingenious appliances which do not take advantage of those prominences. If these cases were dressed thus, we would not see the discussions which now go on as to whether *any* dressing should be applied or not. The substance of the objections to *any* dressings are merely a reaction against the practice which seems common of putting a pad over the eye so thick that when the bandage is applied it causes pressure on the eye and in so far as this is the case, the objections have weight. The eyelids are, so to speak, nature's splints and require no support further than to exclude foreign substances and to exclude light. Both eyes should be covered up as the light on the eye, which is not operated on, reacts on the other eye and causes the patient inconvenience. It also allows him to move the exposed eye about while using it, and of course the eye operated on moves about to a similar extent and thus interferes with the rest which it requires.

The patient should now be carried to bed on a stretcher; the most convenient stretcher is one whose web is made of canvas with a pocket sewn up each side, which is placed under the patient before he is operated on. When ready to leave the table, the round side poles are slipped through the pockets and an end stay of iron with a loop on each end is slipped over the ends of the poles at each end of the web, to keep it stretched. This form of stretcher is not in the way of the operator and it is simple, enduring and cheap.

For the after-treatment and the treatment of after-complications *vide* the chapter on that subject

CHAPTER IV.

THE TREATMENT OF IMMATURE CATARACT

IMMATURE Cataract is generally recognized as unsuitable for Daviel's operation while in the immature condition, and I think justly so

By this operation it is impossible to get all the lens matter detached from the capsule, the result of which is, if operated on by that method, that a considerable amount of lens matter is left behind, which swells up and becomes opaque, and is exceedingly likely to give rise to a severe form of iritis which will probably bind down the iris to the capsule and which, with the capsule and its cell proliferation will form a very dense after-cataract For the treatment of such an after-cataract a mere needling operation is not sufficient To efficiently treat such an after-cataract it is necessary to extract it If the iris is extensively bound down to such an after-cataract, it is necessary at the time of its extraction to mechanically detach it from the after-cataract with an instrument and then to proceed with the extraction of it Such an after-cataract could be couched if not adherent to the iris But couching would, in my opinion, be certain to be followed by the degenerative condition of the retina already described as invariably following couching of the lens, though with not so much rapidity of progress

It will thus be seen why few are willing to undertake the treatment of the after-cataract which follows the extraction of the immature lens by Daviel's method with a light heart The following case, in my observation, is a typical example of the complication which practically always follows the extraction of immature cataract by Daviel's method. A. B.,—immature cataract in both eyes—was the principal

of an extensive business firm, his visual incapacity involved large monetary issues to himself and to others, so he was willing to accept any risk

In the autumn of 1906 an iridectomy was performed with the object of maturing his cataract by one of the most experienced operators by the capsulotomy method in the world, the result was, there was no more progress in the maturing of the cataract in that eye than in the other eye which was equally advanced

A few months after the iridectomy he had the immature cataract extracted by the capsulotomy method by the same operator

Five months after the extraction I saw him for the first time. The condition then was as follows — His eye was bandaged up and he was suffering considerable pain. He was using *atropine drops*. On examination there was marked evidence of an active irido-cyclitis, the perception of light was very good, the after-cataract was very dense and the margin of the iris was bound down to it all round. The operator and another consultant of the same school informed him that they regarded the operation as a failure and that nothing further could be done (I shall touch on this case again in the chapter on the treatment of after-cataract)

The pressing claims of patients with cataracts slowly maturing by nature's process often keeping the patient almost blind for years before the case would be suitable for operation by the capsulotomy method rendered it imperative that some means should be tried for their relief, hence the various procedures adopted for the maturing of immature cataract. The procedures adopted for this purpose are —

- (1) Puncturing the lens capsule with a needle
- (2) Iridectomy (simple)
- (3) Iridectomy with massage through the cornea
- (4) Iridectomy with direct massage with some form of instrument

(1) *Puncturing the lens capsule* is liable to be a complete failure or to establish a traumatic cataract. A traumatic cataract thus established may constitute a serious ophthalmic emergency. The formation of the traumatic cataract may be so rapid that the lens may swell up to such a degree as to cause acute glaucoma, and the lens matter may escape into the aqueous chamber and cause acute iritis or irido-cyclitis. The extraction of such a traumatic cataract admits of no delay.

The conditions under which it has to be extracted are highly unfavourable and difficult and the results are far from being as satisfactory as in the extraction of a cataract matured by nature's process. It will thus be seen that when this procedure is efficient in maturing a cataractous lens, *i e*, when it causes a traumatic cataract,—it is fraught with serious trouble and serious danger, and is now, I think, relegated to the operations of the past.

(2) *Iridectomy* in my observation has no influence whatever on the maturing process.

(3) *Iridectomy with massage through the cornea*—I have done this extensively. In my observation it has no influence on the maturing of immature cataract, if the massage be done with a justifiable degree of pressure—that is, pressure which will not dislocate the lens.

It is only an experienced operator who knows the amount of pressure which is justifiable. If any excess of pressure be used, the operator is very liable to dislocate the immature lens in an eye from which the aqueous humour has been released by an iridectomy. Under these circumstances the immature lens is often very easily dislocated, so that in my opinion, if this procedure be adopted within safe limits, both the surgeon and the patient are almost certain to be disappointed.

(4) *Iridectomy with direct massage of the lens with an instrument*—This procedure was adopted on account of the failure of simple iridectomy and of iridectomy with massage through the cornea—the simpler methods.

This is a daring and a most unsafe procedure. Only those familiar with the extraction of the immature cataract in the capsule can fully realize how delicate the capsule in these cases is, and how easily it can be lacerated by the application of the bluntest and smoothest of instruments in the hands of men most highly trained in ophthalmic manipulation and also how easily the lens can be dislocated in these cases by such direct manipulation. If neither of these undesirable accidents occurs, I cannot see how direct massage can be more effective than massage through the cornea. If either of these accidents does occur, the operator is in the awkward position of being obliged to extract the immature lens without delay the best way he can.

It will thus be seen that ripening procedures are either dangerous or disappointing and that the surgeon would be better advised to either wait for nature's ripening process or to extract immature cataract in the capsule.

While I condemn these ripening procedures I fully appreciate the demand which has caused their initiation—the demand for some procedure by which men of active mental and bodily habits could be relieved of their condition without remaining practically blind for the years through which nature's process would run, before they could be operated on by Daviel's method. The demand is pressing—delay may mean want to the family whose bread winner is the subject.

It may mean when the subject has waited for his cataract to mature by nature's process, that his business has passed into other hands and that, at his time of life, he is badly fitted to begin a career *de novo*. It may mean that the community has lost a number of years of the services of one of its most important members. In any case, the delay occasioned by waiting for the completion of nature's ripening process involves mental depression, the degree of which can be best appreciated by those of extensive experience in the treatment of cataract, but hardly less so by the general practi-

tioner whose patient the subject is, mental depression allied to that incident to the prospects of confinement in a dark cell without labour—a form of judicial punishment admissible in no civilized country

We come across patients who insist on a definite opinion, be it good or bad and who will not be shelved. I have known such men, when told that they had immature cataract and that they would have to wait for a year or two before it could be operated on suffer from mental depression consequent thereon which was little short of what would follow on an order for their execution. The surgeon who intends to wait for nature's process of maturing should be very careful to avoid informing patients that they have immature cataract until he cannot help it, and then he should not lead them to believe that they have long to wait for it to mature. This may seem to be "humbugging" the patient. It is not, it is saving him as much as possible of the mental strain to which he would otherwise be subject. The surgeon can save his own reputation by informing some member of the family of the real state of affairs.

It will thus be seen that—

- (1) Extraction of immature cataract by the capsulotomy method is hardly justifiable
- (2) Ripening procedures are either unsatisfactory or dangerous.
- (3) To wait for nature's maturing process is highly unsatisfactory and detrimental to the patient

The treatment of immature cataract which I practise extensively, of which I am an ardent advocate, and regard as the procedure of the future and which will make mature senile cataract a much rarer condition than it at present is, is extraction in the capsule of the immature lens—a procedure to which immature cataract is admirably suited. In fact, even the normal lens can be extracted in its capsule as easily as the ripe one by those skilled in the art.

The stage of its immaturity at which I advocate its extraction in the capsule is the stage at which it unfits its possessor for the performance of his ordinary duties. I hold that if for no other reason than for the treatment of immature cataract, every ophthalmic surgeon should be familiar with the art of extracting cataract in the capsule.

CHAPTER V

EXTRACTION OF CATARACT IN THE CAPSULE

EARLY in my experience in operating for cataract by Daviel's method it occasionally occurred that a troublesome patient on the completion of the corneal incision strained violently and pressed out both the lens in its capsule and a quantity of vitreous. Imbued with the teaching of the schools, I at first regarded these accidents as serious and I watched events closely expecting dire results, either immediate or remote. I was agreeably surprised to find that the immediate results were beautiful, and that vision was ideal as far as vision after cataract extraction can be expected to be ideal. On observing a few of them during some years, I found that no deterioration followed the free escape of vitreous in those cases, such as atrophy of the retina or detachment of the retina, and that these eyes seemed quiet, and that their vision was all that could be desired. I then began to doubt the existence of the facts on which was based that holy horror of escape of vitreous, which the schools teach, and to think that the doctrine on this subject, however it originated, was never seriously questioned and carefully examined by the light of facts.

I proceeded to use my own judgment as if schools did not exist. I proceeded to imitate the accident and to extract in the capsule with such precautions as I could then conceive to avoid loss of vitreous as much as possible.

My object was to remove the cataract in its entirety and as far as possible to cause no injury to any other structure beyond what was absolutely essential.

The stages in the development of the technique which I now adopt need not be gone through. Suffice it to say,

that I was working single handed and alone, untrammelled and unhelped by the teaching of any one, fully aware that I had to stand alone against the ophthalmic world and its prejudices and aware that prejudices die almost as hardly in things of this kind as they are proverbial for so dying in matters of religion. It is thus not necessary to say that I have considerably altered the manipulative procedures which I described in my early papers on this subject, until at the present time I think I have left little in this respect for anyone, who follows me, to alter or amend.

It is amusing to read papers on this subject by teachers of ophthalmology on their experience of ten, or under ten, cataract extractions by "Smith's method," in which they lay down that in none of them did they adopt the procedure recommended by Smith, and that they altered their technique in almost every case, and on the strength of such insignificant experience, to see that they condemn the operation. It is equally amusing to see such papers seriously commented on by ophthalmologists. They should have called the operations by their own names and not "Smith's operation." How loud does the vacancy of inexperience speak!

They may have been right to condemn the operation in so far as they personally are concerned, there are more factors in this operation than the mere knowledge of the technique which my unrivalled experience has dictated, even after seeing three or four hundred cases operated on by one who can do it as it ought to be done, and having detailed instructions from him at such operations. For this operation there is nerve required in the operator, he also requires to have a "good eye" and a "good pair of hands" well trained in the art of ophthalmic manipulative procedures, extraction of cataract in the capsule is the most highly technical operation in the whole range of surgery. I can no more understand a man being able to operate, as it should be done, from a mere written description of this operation than I can understand a man proceed-

ing to successfully play the violin from a written description of the art without practice and without teaching. The art must be learnt by demonstration and by actual practice before a competent operator

When inexperienced the usual procedure we adopt in surgical practice is to follow as carefully as possible the teaching of experienced and competent men, until we have enough experience of our own to feel confident to act on our own initiative. We should not be the blind followers of any school, nor yet are we safe, when inexperienced, in roughly casting aside what experience has taught others.

Cataracts of all kinds and in all ages except in children and in juveniles are suitable for this operation and none are more suitable than immature cataracts, even the normal lens can be extracted in the capsule if the operator knows how to do it. Cataracts in children and in juveniles are exceedingly difficult to dislocate, and are in consequence unsuitable for this operation.

THE OPERATION

The eye should be prepared as described in the chapter on David's operation, except that atropine is not necessary.

The operator should make his incision by inserting the knife in the sclero-corneal margin and diving it straight across the pupil and out at a corresponding point in the opposite side and by cutting out in the cornea.

For the largest and most swollen lens when the knife is across the eyeball, the back of it should appear the slightest thing less than across the centre of the pupil and for smaller lenses a little smaller incision than this is sufficient, that is, that in all cases the incision is less than half the circumference of the cornea. The usual way of describing the size of the incision in millimetres is confusing to the operator and he who tries to follow such measurements in practice will find that it is confusing. In the eye itself we have the landmarks—the centre of the pupil and sclero-cornea—which are sufficient for all practical purposes and

are visible without any confusion throughout this part of the operation. This operation can be done equally well with any incision provided it is of sufficient dimensions. In the case of a small cornea the operator would do well to enter his knife more sclerotic than sclero corneal, as it is the depth, at which the knife is entered, which very largely determines the amount of space the wound affords. The operator never regrets having made his incision a little larger than necessary, he always regrets having made it too small. Just before the incision is completed, if the patient be troublesome, the assistant should lift up the lids on the speculum and should draw back the brow with his thumb, so as to prevent the patient from pressing out the lens and vitreous on completion of the incision. If the patient be very troublesome, the operator should dispense with the speculum and his assistant should place the face of his left thumb on the patient's face just below the lower eyelid and draw it down, while with his other hand he should lift forward the upper eyelid on the blunt hook retractor and draw back the brow with the little and ring finger of the same hand, so as to expose the eye for the operator. By this procedure it is practically impossible for a troublesome patient to press out the lens on completion of the incision.

If the speculum is being used while the incision is being made and the patient does succeed in pressing out the lens or the lens and some vitreous on completion of the incision, the operator should remove the speculum as quickly as possible—hence the importance of using a spring speculum as distinguished from one with screw fixation—and complete the operation by the above described method of retraction. If he does not take out the speculum quickly, the patient almost always goes on pressing and the speculum being a *point d'appui* for such pressure to act on, he will rapidly empty the eyeball of vitreous. This, of course, applies to this stage of the capsulotomy operation with equal force. An iridectomy should now be performed if the operator

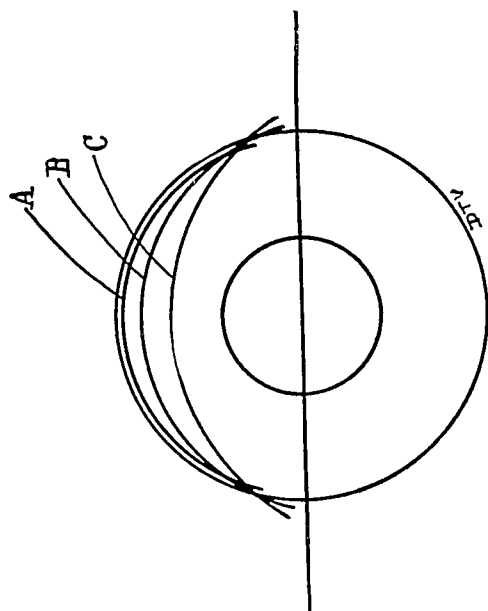


Fig 23 Showing the three lines of section that can be made
 A—Peripheral, with or without conjunctive flap B—The preferable site of the section C—The section to be preferred in case of simple extraction

intends to do the combined operation. This operation can be done equally well without an iridectomy (for how to do an iridectomy, *vide* the chapter on Daviel's operation)

The only object in doing an iridectomy in any cataract operation is to avoid the after-complication of prolapse of the iris. An iridectomy in my observation in the combined operation does not prevent glaucoma from following, either post-operative or later on. Atropine is not necessary in this operation even if the operator is going to do the simple operation. It is quite a simple matter to extract a cataract in its capsule without atropine through a pupil contracted with opium. However well the pupil may be dilated with atropine, once the incision is made, the pupil contracts. If extracting in the capsule without an iridectomy through a pupil contracted with opium, the operator should put on his pressure over the cornea steadily and not hurriedly, which will cause the muscle of the iris to relax from exhaustion just as a man who has an excessive weight in his hand, his elbow being flexed at a right angle, finds that the muscles which flex the forearm on the upper arm gradually become tired out and relax. The only object which atropine serves in this connection is to keep the pupil dilated in the event of iritis following. It is thus necessary in Daviel's operation on account of the liability to iritis following in that operation. It is not necessary in extraction in the capsule as iritis practically never follows in it. Atropine or eserine is useless to prevent after prolapse of the iris, I have tried both drugs in the simple operation and I found that I had less prolapse without either.

Atropine, in this connection, is a drug which should never be used without a definite indication. It causes conjunctival and other local congestion, and may cause post-operative glaucoma, and it is a considerable advantage to be able to do without it. The patient should be taken throughout as quietly as possible. He should not be asked to look in any direction, the result of which is that he generally fixes his eye in the position of rest or of sleep—the

most convenient position for this operation. Besides, any call on the use of his mind disturbs him and wears out his nerve with great rapidity. I generally find that he is unable to do what would be wanted in this respect, however desirous he may be, and that such strain makes him more irritable and more troublesome than he otherwise would be. If his eye be fixed in the natural position for him to fix it, *i e*, the position of rest or of sleep, there is much less liability to escape of vitreous than if he be looking downwards. If he persists in looking downwards as an occasional patient will do, he will be almost certain to squeeze out vitreous after the lens has escaped in case the corneal incision be an upper one. If a lower incision be made in a case which persists in straining with a downward look, he is not liable to have an escape of vitreous. The explanation of these facts apparently is, that it is the rectus opposite the incision as distinguished from the rectus adjacent to the incision which produces the pressure which squeezes out the vitreous in these cases of a strained fixed position of the eyeball. If patients who strain with a fixed downward look are made to voluntarily close the other eye as in sleep, both eyes roll upwards. This is a thing the patient can easily do and which overcomes this difficulty.

In cases in which the combined operation is being performed the iridectomy having been performed (how to do an iridectomy, *vide* chapter on Daviel's operation) the speculum should be removed and the assistant should take charge of the eyelids. He should retract the lower eyelid by placing the face of his left thumb on the skin of the face immediately below it, and by drawing it down. If the face be slippery, or if the patient be troublesome, he will do this with more ease if he places a little dry sterile wool under the face of his thumb. He should lift forward the upper eyelid on the blunt hook retractor which he should hold between his thumb and index and middle finger, and he should use the ring finger and little finger of the same hand to draw back the brow and the orbicularis muscle. He should lift



Fig 25 Showing the proper position for the assistant to assume in controlling the orbicularis and the brow by means of the lid hook in his right hand, and the lower lid and patient's head by means of his left hand after the iridectomy and before the operation uses his lens hook for expressing the cataract in its capsule. If all goes well this position is maintained without shifting until the operation is completed.

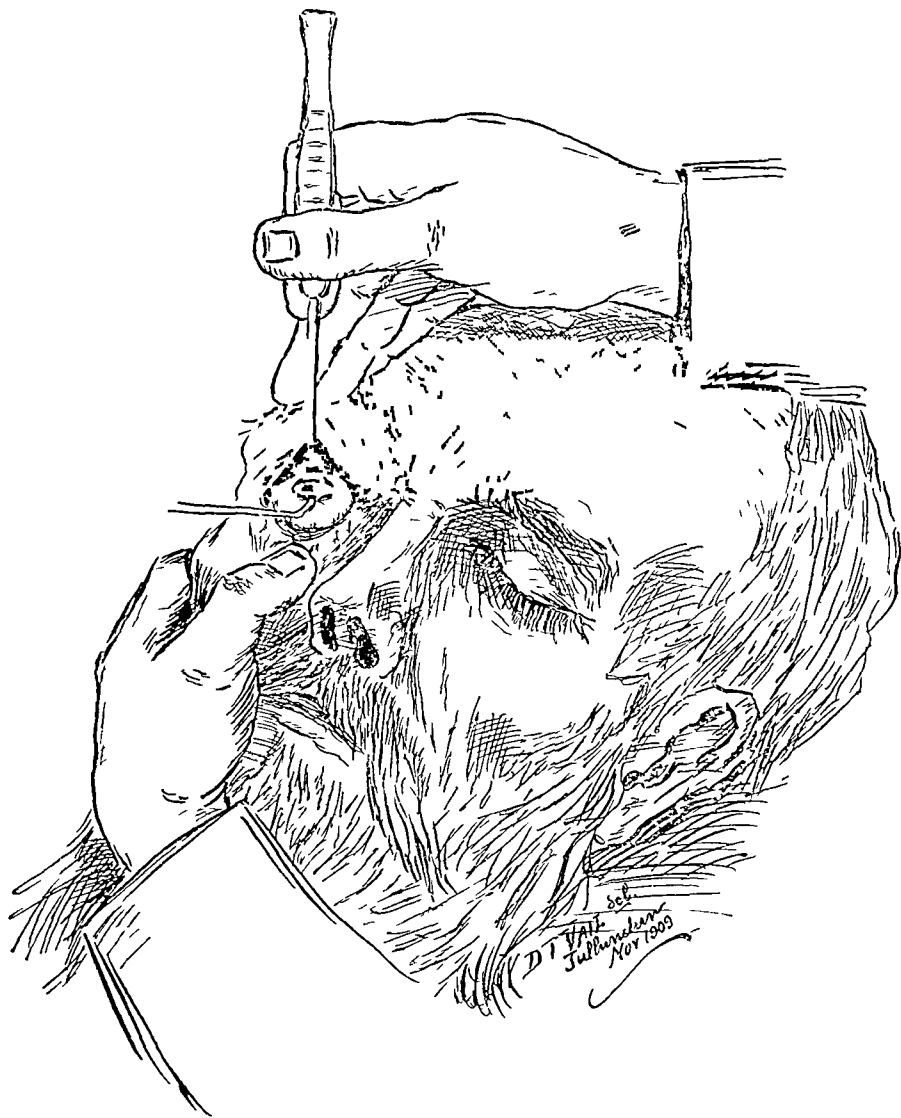


Fig 26 Showing the proper position of the assistant's hands in holding the eye lids, while the operator is expressing the lens in its capsule through an upward incision (notice how the eyebrow is being held up by the assistant's three fingers) The upper lid is hung on the lid hook exposing the summit of the eyeball The lower lid is everted by the thumb of the assistant's left hand

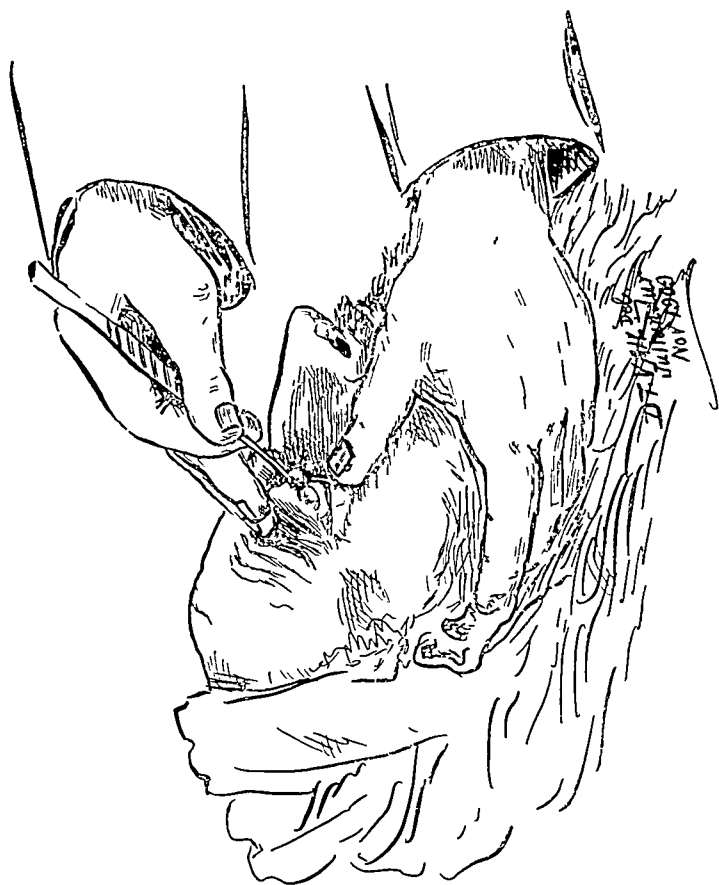


Fig 27 Companion to preceding figure to show how the assistant shifts his position in case the vitreous presents or is lost. Notice that he tilts the handle of his hook toward the patient's feet in order to lift the cul de sac of the upper fornix. The effect of this is to suction the vitreous back within the globe or at least to prevent further escape. The thumb of his left hand is straightened out in order to give the operator room to work in this new position.

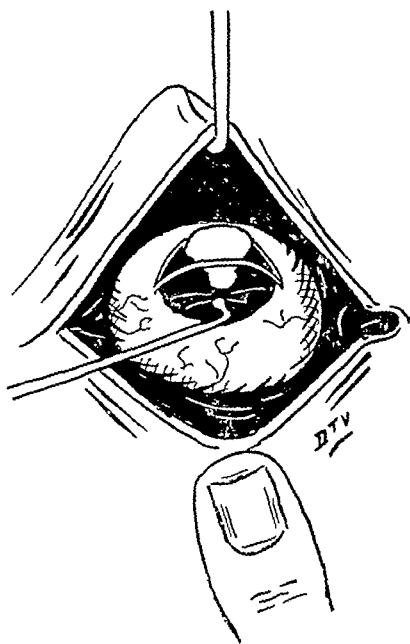


Fig 28 Showing where deep pressure is made with the bulbous end of the lens hook pressing back toward the optic nerve, while the lens moves out in the upright position. The corner should be tucked behind the lens thus completing its birth.

the upper eyelid on the blunt hook retractor straightforward as if he were lifting the contents of the orbit out of the socket. By this procedure he will have the orbicularis muscle completely under his control and will have thoroughly exposed the region for the operator.

If the assistant lifts the upper eyelid towards the brow, the patient will be able to put pressure on the eyeball, whereas if he lifts it straightforward, he will not be able to put on such pressure.

It is *very* important that the assistant should thoroughly understand how to do this part of his duty and that he should do it properly.

The operator should now proceed to dislocate and to extract the lens.

The immature lens, the hard mature lens, *i e*, the lens with very little soft cortex—and the hypermature lens generally dislocate first at the wound. Such lenses do not mould much and are best dislocated at the wound first from every point of view.

To do this—I assume throughout that the operator makes his corneal incision above—the operator should take the spatula previously described in his left hand as he holds a pen to write with, and place the end of it vertically on the cornea to the left side over the lower third of the lens. In his right hand he should take the blunt hook as he holds a pen in writing, of both his instruments he should take a rather long hold, *i e*, he should hold them much further from the point than writers usually advise. His left hand should rest on the patient's head throughout this procedure. The little finger of his right hand should rest against the patient's temple in the case of the right eye, and the shank of the blunt hook should glide across the bridge of the patient's nose while doing the left eye. By these means there should be no danger of his instruments plunging and the operator should be in a position to use and to control his instruments with the necessary lightness and delicacy. The end of the

spatula having been thus applied over the lower third of the lens to one side of the cornea, the ball end of the blunt hook should be applied to the cornea between the spatula and the other side of the cornea over the lower third of the lens, and both instruments should be applied with about equal pressure straight backwards towards the optic nerve region in the immature lens, the hypermature lens and the ordinary hard cataract so as to dislocate them first at the wound. The spatula should remain stationary, whereas the ball point of the blunt hook should be drawn from side to side, making pressure as it is so drawn across the cornea. The shaft of the blunt hook should, throughout this manœuvre, be as nearly horizontal as possible. By putting on a certain amount of pressure with the left hand instrument, the operator leaves less pressure to be exerted by the right hand instrument, and thus he can manœuvre the hook about more lightly.

The spatula, thus used, helps to fix the eyeball which would roll about a little if this manœuvre were done with the blunt hook alone, and such rolling of the eyeball would be inconvenient to him. Up to the point at which the border of the lens at the wound appears dislocated—when it is dislocated the clear vitreous will easily be seen between the tilted edge of the lens and the sclerotic flap of the wound—the blunt hook and the spatula are used to put on pressure, backwards towards the optic nerve region. Once the lens is dislocated at the wound, the spatula in the left hand should be kept in position and should be used to follow up the lens through the cornea, but should not be used to exert any appreciable pressure, the right hand instrument being sufficient. The blunt hook should continue to be used to put on pressure after the lens appears dislocated at the wound, gradually more and more towards the wound itself with the same transverse gliding movement. At first its position on the cornea should not practically be shifted, but the direction of its pressure should be altered, slightly at first and gradually more and more until it finally folds the cornea underneath

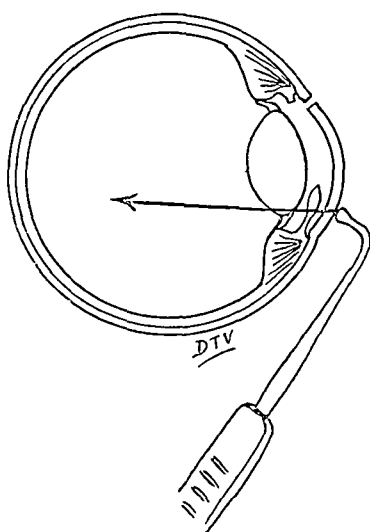


Fig 29 Showing the spot where pressure is about to be made on the corner with the lens hook. The direction of pressure will be as shown by the spear. The lens will be tilted forward at the upper edge and the corneal wound will gape to allow its passage out.

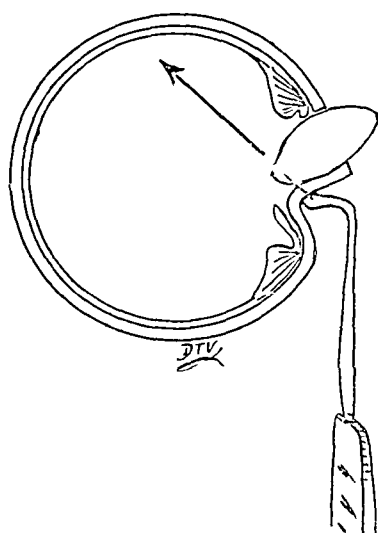


Fig 30 The lens is coming out in the upright position and the corner is kept in near apposition to it as it moves out, at the same time pressure is gently made in the direction of the spear in order to tuck the corner behind the lens

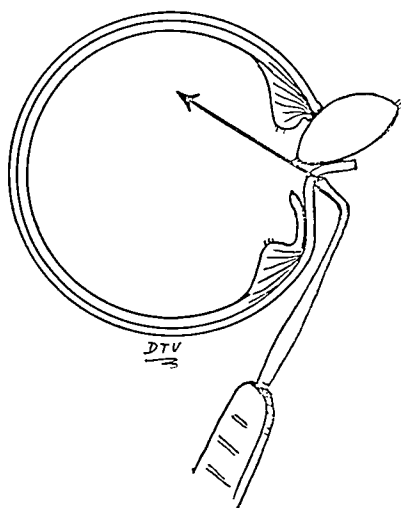


Fig 31 The lens has come out upright and the corner is being tucked behind it, pressure used in the direction shown by the spear. Such a lens will sometimes slide over the top of the eyeball into the upper cul de sac where it can be secured by use of the lens hook. Sometimes it turns down and lies on the outside of the corner where it is easily removed with the hook.

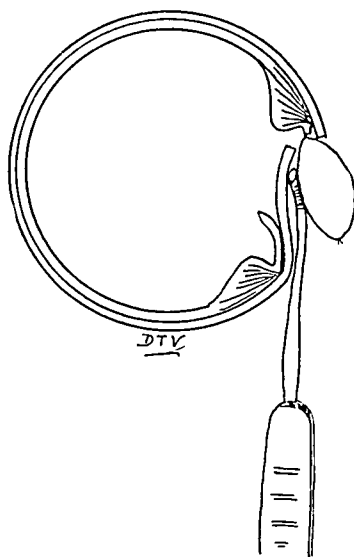


Fig 32 The lens has been delivered upper edge first and as the cornea was tucked under and behind it it has dropped on the outside of the cornea and can easily be removed

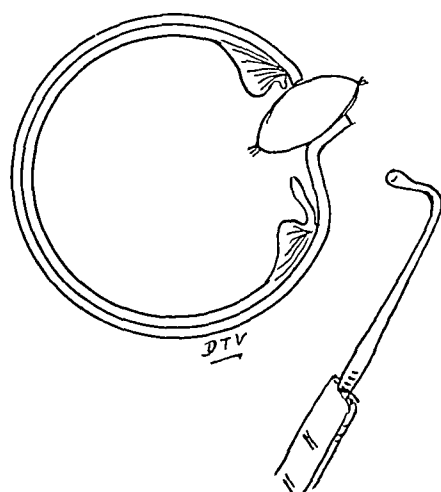


Fig 33 Showing the mistake that is sometimes made by beginners by taking the lens hook off the cornea before the corner is tucked behind the lens. This lens will settle back and will have to be delivered over again.

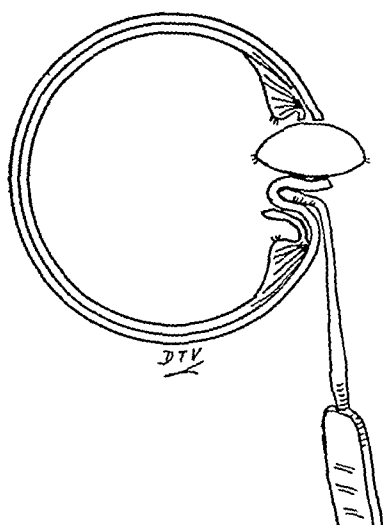


Fig 34 The incision is too small and the lens cannot pass. It stands in a vertical manner nearly but not quite half way out. Deep pressure may be made to cause the corneal flap to slip behind the lens and the lens delivered by skilful use of the concave side of the hook under its rim. The convex side of the elbow gently insinuated in the wound, thus rolling it out toward the patient's right side of the wound. Or the lens spoon held in the left hand may be used to keep up the vitreous tension, while the hook is used to deliver the lens.

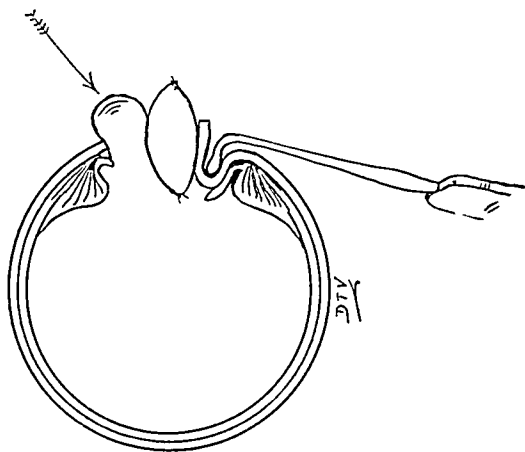


Fig. 35 The lens hook has been used in the effort to turn the lens in a case that was properly one for upright delivery. The consequence being that the suspensory ligaments above ruptured and vitreous allowed to escape. In this case pressure toward the patient's feet should not have been made for it was not a "tumbler," the thing to do now is to shift the pressure upward to close the gap and at the same time deliver the lens on the spatula.

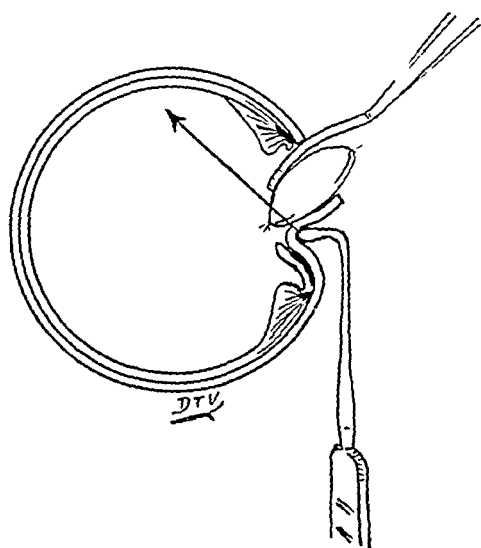


Fig 36 Vitreous showed a tendency to present and the operator has passed the lens spatula in the wound behind the lens, holding it steadily there while the lens hook presses it out on its inclined plane, making pressure in the direction shown by the spear

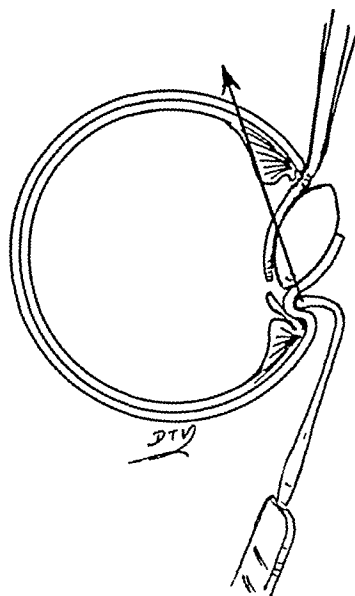


Fig 37 Showing how the lens spoon held by the operator in his left hand is placed behind the lens in some cases of very tough suspensory ligaments (hyper mature or disciform cataracts) and pressure applied with the lens hook to slide the lens up the inclined plane, thus avoiding vitreous loss. The spear shows the direction pressure should be made. The lens shown in this figure is much too thick to illustrate the shrunken hyper mature lens.

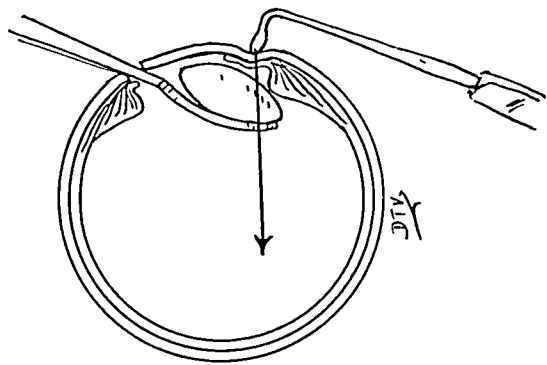


Fig. 38 Showing where the lens has been dislocated and lies behind the iris and ciliary body. The spoon is passed deeply within the vitreous chamber behind the lens and the lens is brought forward and stored against the cornea, while the lens hook expresses it against the vitreous which furnishes an inclined plane and a buck stop to guard the vitreous. The spoon shows the direction pressure is made to start the lens on

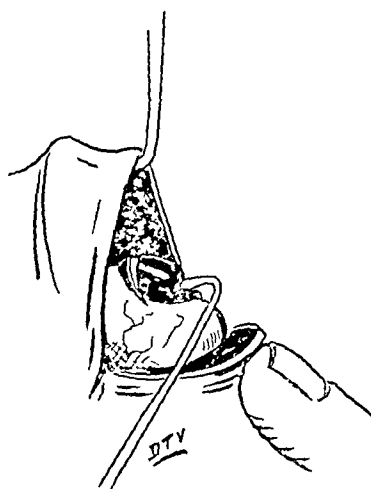


Fig. 39 Showing the side view of the eye in the act of beginning the pressure to deliver the lens. The wound is just beginning to open to let the advancing lens pass through, while steady deep pressure is being made to complete its delivery. The upper lid is held on the lid hook by the assistant and the lower lid everted with his thumbs.

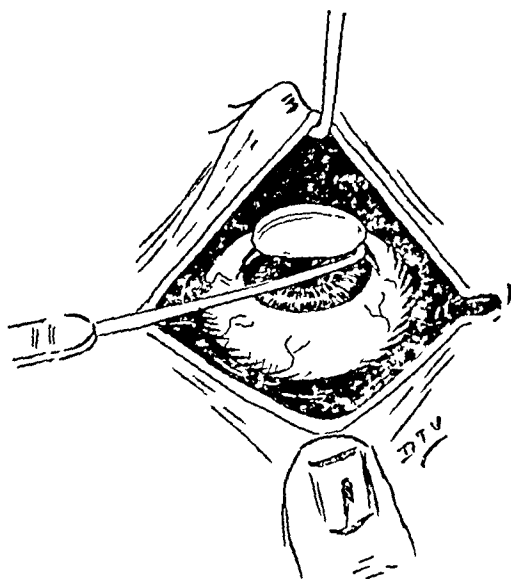


Fig 40 Showing how the lens is gently raked away from the incision by means of the same lens hook which delivered in out of the eye. The bulbous end of the hook is turned well up *away from the wound* while the concave elbow hugs the body of the lens and gently removes it from its final attachments. The convex elbow is depressing the lips of the wound insuring approximation and locking the wound against accidental return of the lens within the eye.

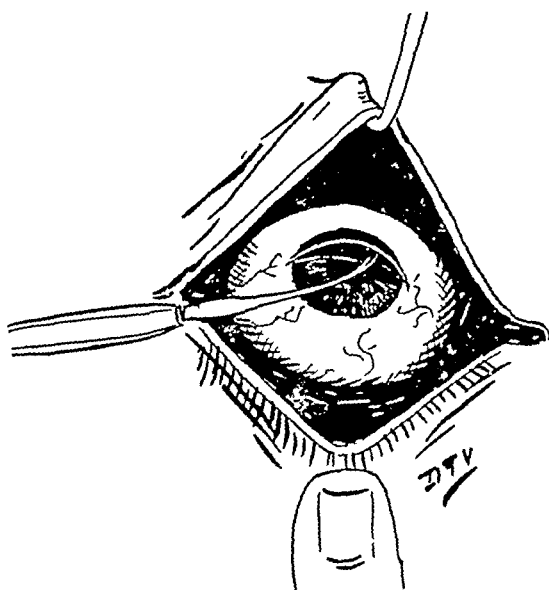


Fig 41 Replacing the iris after the cataract is extracted. The assistant still holds the upper lid away from the eyeball by means of the lid hook, and everts the lower lid with the thumb of his left hand, while the operator uses the iris repository to make the cut root of the iris from its position against the scleral side of the corneal cut. The cut iris root clings to this cave like projection and should be separated by pressing the iris spatula along under this cave from one end of the incision to the other. Notice that in doing this the end of the spatula points upwards toward the summit of the eyeball.

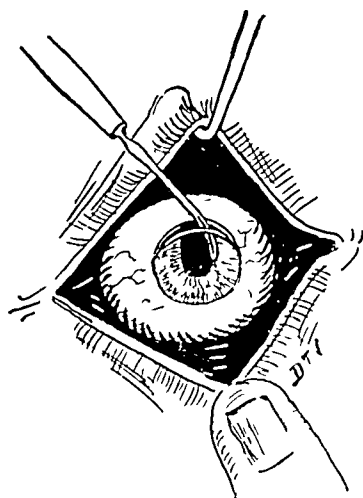


Fig 42 Showing how the cut margins of the coloboma are restored with the iris reposer. There is always a fold at each angle of the cut iris near the ends of the incision, and these should be "ironed out," thus replacing the pupil well down, thus avoiding the drawn up pupil. This is the last act of the operation.

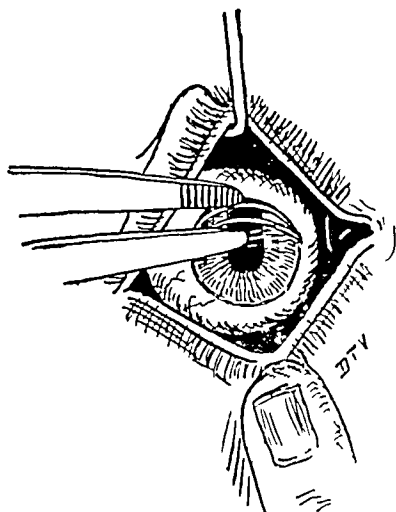


Fig 43 Showing the method of grasping the capsule which has ruptured and hangs half out of the wound. Ordinary well made dissecting forceps are used as shown, the pressure and movement being made with the lower arm of the forceps, while the upper is held steady at the scleral lip of the wound

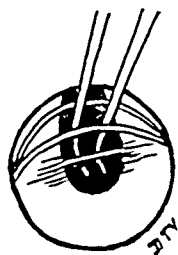


Fig 44. Showing the iris forceps going into the eye in the act of grasping the capsule which has ruptured and remains in the pupil space after the nucleus of the lens has escaped

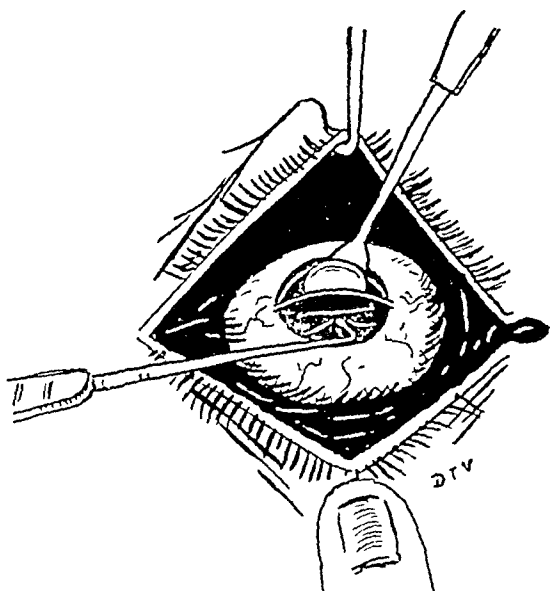


Fig 45 Showing the tip of the spoon entered into the wound behind the lens in cases where the vitreous presents or there is an ominous gap on pressure. The spoon is held steadily as a back ground for the lens to slide out against thus taking the strain off of the vitreous. The hook is following the lens up and making all the pressure. The assistant's thumb is shown holding the lower lid down. Notice the upper lid is hung on the lid hook.

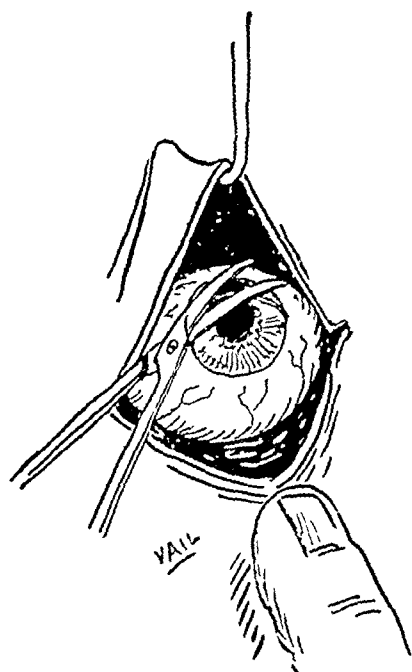


Fig 46 There has been an escape of vitreous. The lens, however, has been extracted. The operator turns off the vitreous hernia as shown in the figure, while the assistant draws the eyelids well away from the ball, and at the same time pushes the eyebrow well upon the forehead thus preventing further escape.

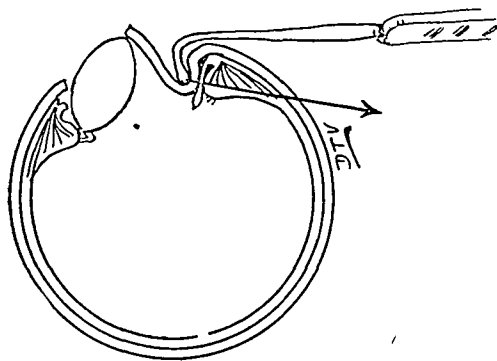


Fig 47 Showing how the lens will turn and present lower side first in cases of tumescent extract when the lens hook is engaged on the ciliary ridge and traction made toward the patient's feet. At the stage shown in this figure the pressure should now be shifted toward the wound and the cornea tucked behind the lens

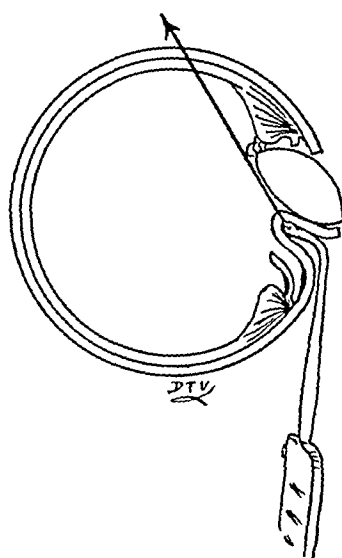


Fig 48 The lens is coming out lower rim first ("tumbler") The spear shows the proper direction in which to press in order to tuck the cornea behind the lens The lens is still attached by its upper suspensory ligaments

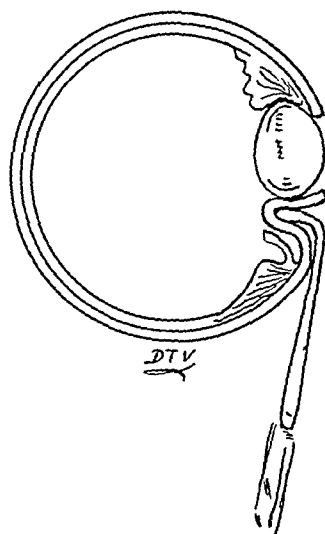


Fig 49 The lens is detached from its ligaments below and is being jammed upward against the ciliary body and behind the scleral side of the wound. It cannot be delivered in this position, and if pressure is kept up, either the capsule will burst or the vitreous will escape. The thing to do is to let go and start over again. If it recurs, slight pressure with the lens spoon on the upper (scleral) side of the wound, if done at the right time and the right way, will permit the upper edge of the lens to come out through the wound.

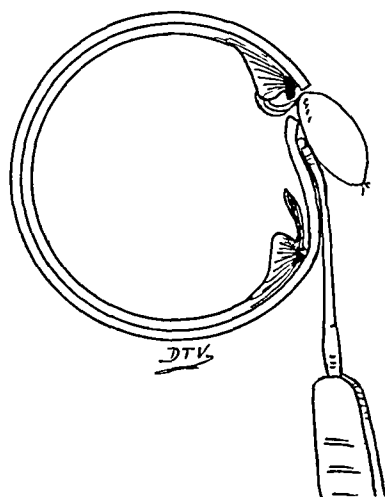


Fig 50 The lens has presented lower edge first through the wound and the cornea is tucked behind it, thus insuring its ultimate safe delivery The suspensory ligaments are still attached above and the lens will now be rolled out sidewise like a cart wheel, these upper attachments being broken This is done as shown in figure 40

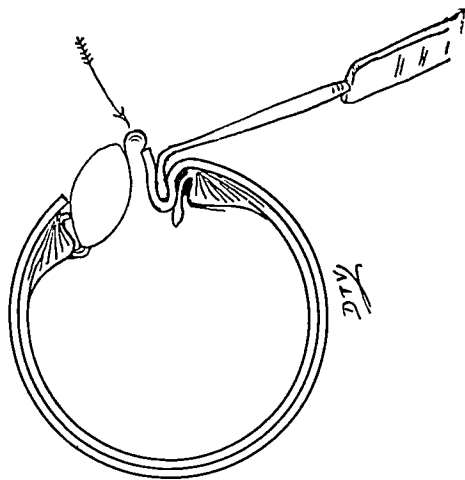


Fig 51 The lens hook is engaged over the ciliary ridge and too much pressure toward the patient's feet has been employed (see causing the lens to turn too rapidly and vitreous to present (see arrow) below in before the lens is born Pressure must be quickly shifted upward to close the gap where vitreous presents and cause the lens to be delivered in the usual way for "tumblers " No harm results

the lens at which stage the lens is delivered or almost so. The manœuvre with the blunt hook after the first appearance of dislocation of the lens implies a gradual rotation of it on its long axis until its ball end is directed finally towards the wound. It will be seen that by this procedure the operator wishes to keep the lens up to the sclerotic flap on the one hand and to practically put no further pressure on the vitreous. If the lens be not fully delivered, the spatula, which has been used to follow up the lens, should now be used to put on such pressure through the cornea as will keep it in position and prevent it from slipping back into the eyeball while the lens is caught in the curve of the blunt hook and tilted out. In doing this latter, care should be taken that it is caught in the curve and that its capsule is not torn with the end of the blunt hook, the hook on the flat being applied over the sclero-corneal wound and even a little pressure made with it on the sclero-cornea, so as to get hold of the lens below its axis. In no case should the blunt hook be thus applied to help out the lens until after its axis has been clearly delivered, as if such be done, the operator is very liable to rupture its capsule which will then retract after the escape of its contents. If such does occur, the operator should keep up the pressure with the spatula, and lifting the dissecting forceps on the first appearance of the capsule having burst, seize the lens and capsule tightly, as close to the corneal wound as possible. By doing so the soft matter and nucleus will be squeezed out of the forceps grip and it will still have a firm hold of the capsule which can be thus drawn out. In no part of the operation should the operator be more on the alert than to observe the first giving way of the capsule when half the lens or two-thirds is delivered, and to instantly seize it with the dissecting forceps, which is the best instrument for the purpose.

The lens being delivered, the vitreous will be seen to be in its normal position and uninjured. The cornea will be seen to have fallen back and the eye to have the space vacant, formerly occupied by the lens and aqueous humour.

The iris, if at this stage prolapsed, should be replaced with the point of the blunt hook—the best of all instruments for the purpose. To do this, the shank of the blunt hook should be placed against the margin of the upper eyelid with the ball point turned towards the fornix, so that, when revolved on its long axis, the ball point will slightly depress the scleral margin of the wound and, thus by such twist, it will have dropped into position over the base of the iris along which it should be drawn from one end of the wound to the other, taking care that at both angles of the wound the base of the iris is detached from the wound as the angles are the points at which it is almost always caught. By this procedure it will be seen to drop back on the vitreous. It will be observed that I particularly mention replacing the base of the iris. The pupillary margin of the iris can always be left to take care of itself, if the assistant has charge of the lids as above advised. By resting the shank of the blunt hook in this manoeuvre against the margin of the eyelid or over the bridge of the nose, the operator is enabled to use it with the necessary delicacy and accuracy.

In extraction in the capsule the immature and the hard cataract, behave beautifully. The so-called hypermature cataract apart from cataracts in children and in juveniles is incomparably the most difficult of all cataracts to dislocate, though we generally see it stated by people of evidently little experience of this operation, that it is the only variety suitable for extraction in the capsule.

When the hypermature lens dislocates at the wound, the operator must be ready to shift the spatula into the clear point of vitreous behind it, the moment it is evident that further corneal pressure will cause vitreous to escape. Cataracts of this variety are so firmly anchored that, as a general rule, they will not move further from pressure applied through the cornea, once they are dislocated at the wound. In moving the spatula into the vitreous behind such lenses, the operator should wait until he sees the clear point of vitreous between them and the scleral flap. His instrument drops

into such clear point without any more obstruction than it would drop into water. He should shift the spatula well across behind it, taking care not to rupture its capsule with the end of the spatula and should use the spatula simply to support the lens when he proceeds to manipulate it through the cornea with the blunt hook as he manipulates an ordinary case at this stage. He should take care that his spatula is so held that he will not press the lens through the cornea against the end of it, as if he does, he will rupture its capsule.

By simply supporting it on the spatula and manipulating it from the outside with the blunt hook, he makes it slide up the inclined plane of the spatula. When he is bringing up the spatula to drop it into the clear point of vitreous, he should keep the lens in position by pressure with the blunt hook. This retains the point of vitreous clear and visible. The spatula should be used merely to support the lens and thus to prevent further pressure being put on the vitreous in its expulsion. If the operator attempts to lift out such lenses or any lens on the spoon, he is almost certain to rupture their capsule by so doing.

The hypermature lens not infrequently refuses to dislocate until it is outside the wound *en bloc* and until the cornea is folded beneath it.

The remaining varieties of cataract are included under the terms intumescent and mature cataracts. These terms I here use to denote cataracts with a small nucleus and a considerable amount of soft cortex which admits of their being moulded during extraction. From some cause or other the capsule in these varieties is more liable to burst than in any other in extraction in the capsule. If they are dislocated at the wound first—a thing very easy to do—the capsule is very liable to burst when the lens is half out and to retract after the escape of its contents. If such an accident does happen and no attempt is made to extract the capsule, the patient is in the same position as if Daviel's operation had been performed. To avoid this accident, the lens in these cases being mouldable should be made to turn a somersault,

in which case the part of the capsule most distant from the wound is first dislocated, which admits of the lens rolling over on the hinge of suspensory ligament at the wound

Even by this procedure the capsule is so weak that it occasionally bursts when the lens is almost out, but in this case the capsule is in such a position, having rolled out of the wound and being detached except in the neighbourhood of the wound, that it does not retract and can easily be caught with a dissecting forceps and drawn out. A dissecting forceps is the best instrument for taking away a capsule in this position as it takes a broad grip of it and does not tear it as a smaller pointed instrument would do.

To do this manœuvre the operator should place the end of his right and left-hand instrument as on the former varieties, but just over the periphery of the lens and just inside the ciliary ridge—a ridge easily recognizable through the instruments from its greater rigidity than the cornea. The operator should make steady pressure inside the ciliary ridge in a direction pulling away from the region between the optic nerve and the wound, as if, with the instruments, the operator were pulling the eye to look downwards. The patient generally pulls against him, but this is rather favourable than objectionable. By this action the lens will soon be seen to commence to roll over, the lower part of its capsule having been dislocated.

The operator should not relax until the rolling over movement is quite distinct and fairly advanced. He should then alter the direction of his instruments completely and follow it up as in the former varieties until it rolls out of the wound. Though these lenses have the weakest capsules, they are about the nicest of all lenses to extract in the capsule if the operator be skilful at the manœuvre of making them turn a somersault. They readily present by dislocating first at the wound if the proceeding adopted in the former varieties be employed, in which case they are the most unsatisfactory on account of the liability to rupture of the capsule and to its retraction after the escape of its con-

tents If such an accident does occur, the operator should be on the look-out for it

On the first appearance of rupture of the capsule he should keep the lens in position with the spatula and catch the lens and capsule close to the wound firmly with the dissecting forceps and draw out what is in its grip If by this means he has not got the capsule—he will seldom get it unless the lens is two-thirds out—he should expel the contents of the capsule as in Daviel's operation and then reach in for it with an iris forceps, taking care that he is not passing his forceps behind it, as it is very liable to be nearer the cornea than he would at first sight expect He should reach in his forceps closed to well beyond the centre of the pupil, then allow them to open wide and turn the points of them backwards, press their points a little backward, close them and bring out what is within their grip

By this means he will often bring out the capsule entire, and if he fails, he will have torn a large piece out of the middle of it, which will be more efficient than any needling later on would be

Just a word on very low tension eyes which are otherwise normal except for cataract We meet with such occasionally though not often Here it will be necessary to use the back of the spatula over the sclerotic close to the wound to make counter-pressure so as to bring up the tension of the eye to normal, while the hook is used as in the immature or hard varieties If this is not done, the lens is liable to be dislocated behind the scleral flap

If vitreous prolapse during the operation, it should be snipped off I have seen a few cases (they are exceedingly rare), in which a tag of vitreous stroma acted as a drain and had to be pulled away some days after the operation

After the lens is extracted in the capsule, there is no need for flushing out the conjunctival sac or for clearing it with swabs A trace of lens matter or of blood left in it does not

seem to matter, but douching and swabbing are liable to upset the patient's nerve and to cause him to press out vitreous. After the lens is out and the iris replaced and prolapsed vitreous, if any, snipped off, the assistant should be directed to release the eyelids. The lid margins should be smeared with a little dilute yellow oxide of mercury ointment made up with thin vaseline, so as to prevent their eyelashes from adhering until the next dressing. This second dressing should not be done, if there is no special indication, until, at the earliest, six days after operation or, better still, until eight 'or even ten' days after operation. This I shall deal with in the chapter on the after-treatment of cataract operations. If the eyelashes fix the eyelids, the consequence is considerable inconvenience to the patient, whereas if the lids are free to move, the patient does not complain of such inconvenience. The eye should be dressed as described under Daviel's operation.

If the operator is going to extract the lens from the second eye of the same patient at the same sitting—a feature to which there is no valid objection provided the health of the patient is good—he should cover the eye first operated on with a pledget of wool saturated with some sterile solution. This keeps the light, which he cannot bear out of it, and somehow or other it keeps him from winking—opening and closing the eyelids of that eye repeatedly, which some patients instinctively do and which they apparently cannot help doing and by means of which action they are liable to squeeze out vitreous. With the wet pledget thus applied these movements do not occur. The patient, after being dressed on the table, should be carried to his bed and made to rest in the horizontal position for at least three days, after which he may be allowed to sit up.

I assume throughout this chapter that the reader has carefully read the previous chapters and that he will read the chapter on the after-treatment of cataract operations, and on the treatment of the after-complications of cataract operations.

CHAPTER VI

THE TREATMENT OF CATARACT IN CHILDREN AND IN JUVENILES

I HAVE seen a number of cases of mature congenital cataract and in all of them both eyes were affected. Heredity was evidently a cause, as in a number of instances they were members of the same family.

Such eyes are, as far as I have seen, microphthalmic. In my observation microphthalmic eyes are very subject to cataract at an early age. In dealing with cases of congenital cataract, the surgeon should be very careful about his prognosis, the eyes being generally microphthalmic, the retina, among other things, is very liable to be defective in its development. I have recently seen a case of congenital cataract in which the nervous system was very unstable. In it both lenses were successfully needled at the age of three months. The child was brought to me in consultation at five months of age. Before the needling operation its health was perfect except for the cataract. Immediately after the needling, the child began to suffer from *petit mal*, which continued in spite of treatment. I cite this case to shew that, not only should the prognosis be guarded in these cases, but also that the operator should not be in too great a hurry to operate on congenital cataract. On the other hand, it is very important that he should not wait too long, as the evolution of the functions of the retina are dependent on light, and much time lost in waiting in a child with congenital or non-congenital cataract is liable to seriously impair the evolution of the functions of the retina, and in my observation such impairment is only partially recovered from.

The earliest age that I regard it as safe to operate on congenital cataract is from six months to a year. In the non-congenital cataract of children, the sooner they are operated on the better. If the needling operation be performed, the after-cataract should be needled as soon as possible after all the lens matter has been absorbed, and the patient should be carefully refracted and supplied with spectacles for reasonably near vision. The nurse soon ceases to have trouble with the spectacles as such children take remarkably quickly to them for the evident reason that they see so much better with them.

A common impression is, that there is no nucleus in the cataractous lens until about 30 years of age. It is true that the nucleus in such lenses under thirty years of age is small. I have seen a nucleus in cataracts, the subjects of which were under fifteen years of age, and I think the operator will be on the safe side if he assumes that there may be a nucleus at even fifteen years of age, and that a nucleus is the rule after eighteen years of age. It may be small, but it is generally present. The operator, who extracts such cataracts, will have no reason to regret doing so.

The usual procedure is to needle all cataracts in subjects up to thirty years of age, and in the event of a nucleus being present, to extract it afterwards and to needle the after-cataract later on. This involves a multiplicity of operations. What I practice and what I recommend is extraction by capsulotomy.

As soon as I have driven out the lens matter, I pass in a pair of iris forceps, drive the points through the capsule, and draw out either the whole capsule or a large portion of it, which is more efficient than any needling of the dense after-cataract which always follows in children. When extracting the capsule thus, the speculum should be removed. The assistant should lift the upper eyelid forward on the blunt hook and draw down the lower eyelid with his thumb on the skin of the face, so as to prevent or minimise escape of vitreous. Escape should rarely occur, lifting for-

wards the eyelids on the speculum is not nearly as efficient for this purpose. There is one fact which, I think, is always overlooked by writers on this subject, *viz*, that there are, from the operator's point of view, three clinical forms of cataract in children—

- (1) A membrane consisting of opaque thickened capsule, with either no contents or nominal contents
- (2) A capsule with contents of the consistency of milk
- (3) A capsule with contents of the consistency of thin jelly

In the first mentioned variety the cataract is hypermature. In it the lens matter has become absorbed and the capsule is both dense and tough and is anchored with exceeding firmness. The second variety is the ideal one for needling, as its fluid contents, when released, become rapidly absorbed. The third variety in my observation is about as common as the second, and, if needed, the operator will be disappointed, as the opaque jelly-like contents of the capsule do not become absorbed even after several needlings.

This fact I observed early in my career, at the present time I know a girl in England of about sixteen years of age whose cataracts were of this variety. They were each needled six times when she was about four years of age by one of the leading ophthalmologists in Europe. The lens matter was not absorbed and her condition to-day is no better than if nothing had been done. I mention this case to emphasize the fact that cataracts in children should be carefully diagnosed before operation. If of this jelly-like variety, they should invariably be extracted—not needled. The capsule containing milky juice is of a uniform bluish white or white appearance, whereas the capsule with jelly-like contents seems as if it contained flocculæ. The first variety is little different from a dense after-cataract and should receive the treatment of such (*vide* “The Treatment of After-cataract”)

The second variety is the only one that can be successfully needled. The third variety should invariably be extracted by the capsulotomy operation. Cataract in children

and juveniles is not suitable for extraction in the capsule as they are exceedingly difficult to dislocate

Needling —The best instrument with which to needle, is a Graefe's knife with a narrow blade which is sharp for about $\frac{3}{16}$ of an inch from the point, and from that backwards is ground blunt so that it will not cut the cornea

I use this form of knife in preference to any of the forms of cutting needle, as such needles are seldom really sharp and in tearing the dense capsule often seen in children with a comparatively blunt instrument, we are liable to dislocate the lens

In children and juveniles the eyes should be well under the influence of atropine at the time of operation In children it is advisable to use a one per cent atropine ointment two or three times daily for two or three days previous to operation In juveniles, one day thus is sufficient Installation of atropine solutions is likely to make its way into the nose and thus cause symptoms of atropine poisoning

Such atropinization should be efficient for seven days, and thus there will be no necessity for the use of atropine in the after-treatment

The eyes should be prepared as for all ordinary cataract operations The patient, if a child, should be put under the influence of a general anæsthetic If a juvenile, cocaine should be sufficient

The speculum should be inserted and the eye caught and steadied with toothed forceps The operator should insert his knife on the flat, close to the sclero-corneal margin, and when the point of it has passed a little beyond the centre of the pupil, using the puncture in the cornea as a fulcrum, with a sweep, he should make it cut through the anterior portion of the capsule from side to side or from above downwards according to the point at which he has inserted it, and then withdraw it If the iris prolapses into the puncture on the cornea as it occasionally does, it should be replaced with a blunt-pointed probe The eye, being under the influence of atropine, the dressing should not be removed for a few days

unless pain indicates iritis, or increase of tension. The principle of non-interference—rest—universally recognized in the after-treatment of general surgical cases applies with at least equal force to operations on the eye.

This extensive cutting of the anterior portion of the capsule allows it to retract better than the small laceration which is usually made with a needle.

Iritis and increase of tension are rare after-complications if the contents of the capsule be of milky consistency.

The great objection to needling cataract in children is that the after-cataract formed is almost invariably dense—an after-cataract for which a mere needling operation is unsatisfactory.

Extraction—The procedure which I find most satisfactory in all cases of cataract in children and juveniles is to extract them by Daviel's method. The eye should be under the influence of atropine as described under needling. The same applies to the preparation and to the anæsthesia. The incision should be close to the sclero-corneal margin and above. In the case of juveniles, the incision should be about the size required for an iridectomy in glaucoma. In children it should be the size required for an ordinary optical iridectomy.

The capsule should be lacerated with any *really* sharp cystotome, and the contents of the capsule should be expelled as described under Daviel's operation, except that when massaging the cornea with the right-hand instrument, the sclerotic margin of the wound should be depressed with the spatula in the left-hand, so as to admit of the egress of the lens matter and nucleus if a nucleus be present. After the lens matter has been cleared out of the eye, the speculum should be removed and the assistant should take charge of the eyelids as described under extraction in the capsule, so as to prevent escape of a bead of vitreous when the capsule is being dealt with. Escape of vitreous should seldom occur if the eyelids are properly looked after by the assistant. If a bead of

vitreous does escape, it should be snipped off with the scissors—it is of no consequence

With the assistant in charge of the eyelids, the operator should draw down the eyeball with the toothed forceps and should insert a pair of iris forceps closed until the points are well beyond the centre of the pupil. He should then allow them to open wide, direct the points well backward, drive them through the *capsule*, close them firmly and withdraw them with what is within in their grasp. By this procedure the operator will generally extract the whole capsule, if he does not do so, he will bring out a large portion of it, which will be more efficient than any needling of the after-cataract later on could be

If the iris prolapse, it should be replaced with the end of a blunt instrument before the eyelids are released, or an iridectomy may be done according to the fancy of the operator. As I have already pointed out, the above applies to juveniles as well as to children, but I wish to point out that the after-cataract in juveniles is not nearly so dense as it is in children

The eye should be dressed as in an ordinary case of cataract extraction for from three to five days according to the size of the wound. If dealt with in this way, no cases of cataract are more satisfactory than these as far as the operation is concerned

I have never regretted treating cataract in children and in juveniles in this way. I have regretted extracting the lens matter and not dealing with the capsule at the same sitting in cases in which the capsule was apparently thin and transparent. I saw a case not long since in which I extracted the two cataracts of a girl of eight years of age at the same sitting, three years previously. On looking up her record, I found I had extracted the capsule as above described in one eye, and in that eye there was a small escape of vitreous in consequence. I did not extract the capsule in the other eye as it seemed transparent. Both eyes looked perfect as regards result, except that there was a very dense after-cataract in the eye in which

I left the capsule as opaque as the original cataract. With the eye from which the capsule had been extracted, her vision was $\frac{5}{8}$. I extracted the after-cataract from the other eye for her then, and the result was all that could be desired. At the same time I wish to invite attention to the fact that the presence of a dense after-cataract for three years in a younger child than this, is exceedingly liable to permanently impair the development of the retina. I have frequently observed such cases.

CHAPTER VII

THE AFTER-TREATMENT OF CATARACT OPERATIONS THE AFTER-COMPLICATIONS OF CATARACT OPERATIONS, AND THEIR TREATMENT

THE main object in the after-treatment of cataract operations should be to secure as much rest for the eye as possible, consistent with the treatment of any complication which may arise. With this object in view we dress up both eyes, so that the eye not operated on may not be used for visual purposes, as on the one hand its movements would cause corresponding movements in the eye operated on, and the movements of its eyelids would be accompanied by corresponding movement in the eyelids of the other eye and, on the other hand, the light which falls on the eye not operated on undoubtedly causes inconvenience in the other.

The eye should not be rubbed by the patient if it happens to itch as it sometimes does. Nature's splint, the eyelids, should be left undisturbed as long as possible. The room which the patient occupies, should be reasonably dark, as it is very difficult to dress up an eye, so that a bright light does not, to a certain extent, reach it through the dressings and eyelids. The patient should rest in the horizontal position on his back for 24 hours and on either side for the following three days, after which he may be allowed to sit up on a couch or propped up in bed. To condemn a man to rest on his back for four days is little short of torture. Twenty-four hours' rest on his back is necessary after operation, on account of the occasional liability to detachment of the choroid, an accident which usually occurs within two hours after operation. I have seen one case occur eight hours after, and one sixteen hours after operation in eyes which were apparently otherwise normal, and in which there had

not been escape of vitreous at the time of operation The patient should have a laxative or enema when necessary, so that there will be no cause to strain at stool The food should be limited, but of the quality to which he is accustomed I find that my patients do better on such food than on any other Change of diet often upsets their digestion, the people of the Punjab, for example, suffer from diarrhoea if put on an almost purely milk diet and from tympanitis if given soup A tobacco smoker should have his smoke, an opium-eater should have his ration of opium These patients should be able to see some relative as often as they wish, it makes their mind more at ease than any strange nurse can do, and helps them to keep still and to sleep

When should the eye be re-dressed and how often should this be done ?

If all is going on well, as indicated by the absence of pain beyond a mere sense of discomfort in the eye which is invariable in the most favourable cases, the time to re-dress the eye depends on the operation performed If the partial (Daviel's operation) operation be performed, it is necessary to inspect the eye daily, so as to deal with iritis or other complication which may arise, with promptness The frequency of iritis after this operation makes such procedure indispensable Iritis is far from always being associated with pain, whereas the more serious complications are associated with pain In the complete operation (extraction in the capsule) unless there is some special indication, of which pain is the symptom, the eye should not be inspected earlier than between the sixth and the tenth day as iritis is exceedingly rare after this operation In any operation for cataract it is objectionable to disturb the eye in the absence of some special indication sooner than the sixth day, as all such exposures interfere with the rest the wound should have, so as to allow it to heal rapidly, but such interference is necessary after Daviel's operation for the reasons above stated Every exposure to light and every installation of drops cause the patients to wince and thus put

undue pressure on the eye which may cause the healing wound to stretch and to gape and may cause the iris to prolapse

I cannot lay too much stress on such exposures as the great cause of prolapse of the iris. When I used to dress my extractions in the capsule in which I had not done an iridectomy for the first time on the third day, I repeatedly observed that cases which had no prolapse on that day had a prolapse on the following days. Since I ceased exposing them until from the sixth till the tenth day after operation, I find that such prolapse is much more rare. I have seen prolapse of the iris occur after the sixth day, and I am convinced that it would not be anything like as frequent as it is, if the eye were not exposed until the tenth day when the wound would be soundly healed.

The dressing should be well softened with some warm sterile or antiseptic solution before being removed. When pulling the dressing from the lids, the dresser should draw back the brow so that the patient may not be able to strain with the orbicularis muscle and thus put pressure on the eye. The dressing being removed, the brow should be held back somewhat with a couple of fingers of one hand and the lower lid drawn slightly down with a couple of fingers of the same hand, and the eyelashes and the margins of the eyelids cleaned with a little sterile wool saturated with some sterile or antiseptic solution.

The eye should then be exposed and inspected in a dull light for a moment by drawing the eyelids further apart by the procedure already described. Throughout, the cleaning of the eyelids should be done with the utmost gentleness so as to avoid putting any pressure on the eye.

When the eye is exposed, if everything seems all right, nothing should be done but re-apply the dressing, it is only necessary to instil atropine if there is evidence of iritis, under Daviel's operation the instructions concerning atropine were to have the eye thoroughly under its influence before operation, so as to avoid the necessity for its use in the after-

treatment even if iritis were to occur. If thoroughly under its influence at the time of operation, the effects should not pass off for at least seven days.

Any drops put into the conjunctival sac or any douching or swabbing of it in the after-treatment is objectionable, if it can be avoided, and is bad practice unless there is some special indication.

Atropine causes objectionable congestion of the conjunctiva, and so does cocaine, but to a lesser degree.

If a case of extraction in the capsule be dressed on the sixth day for the first time and all looks well, it should not be re-dressed until the tenth day without some special indication. In either operation if there has been no after-complication, the patient can safely have a shade on the tenth day and go home on the twelfth day with a +11 D and a +13 D spectacles. If Daviel's operation was performed, he should return within a month to have his after-cataract treated. Both in Daviel's and in the intracapsular operation the eye should be refracted and the patient supplied with suitable spectacles about six months after operation. If refracted much earlier than this, the spectacles will not suit him later on. In the case of pain in the eye it should be inspected. If all appears right, a few leeches to the temple—four to six Indian leeches and five grains of Pil. Hydrarg., followed by a Seidlitz powder, will generally relieve the patients of such pain at once.

Iritis and Irido-Cyclitis —In inflammation of the iris the conjunctiva is more congested than it would otherwise be. The iris has lost its normal lustre and appears somewhat swollen. Severe cases may also show points of inflammatory lymph extensive according to the severity of the inflammation.

A simple cyclitis after cataract operations, I believe, does not exist, cyclitis is combined with iritis when it does occur.

In an irido-cyclitis the conjunctival congestion is associated with congestion of the scleral vessels, especially over the ciliary region and chemosis is frequent, pain, though not

very pronounced in a simple iritis, may be severe in irido-cyclitis

In either case the conjunctiva may be chemotic, though this, as a rule, only occurs in the severe cases. The lymph cells, usual in an irido-cyclitis, may be seen dotted over the interior surface of the cornea and a hypopyon may exist. These conditions may be septic. If iritis or irido-cyclitis exist and the pupil be not sufficiently under the influence of atropine, the B P solution of the latter should be instilled three or four times daily until the pupil dilates or refuses to dilate. A few leeches should be applied to the adjacent temple without delay, half a grain of calomel with one-sixth of a grain of opium should be given every two hours day and night until there is evidence that salivation is on the point of occurring when it may be stopped for a day or two days; then a grain blue pill (Pil Hydrarg B P) should be given three times daily until the case has recovered. I wish to impress on the reader that in iritis it is important to get the patient under the influence of mercury within 24 hours if possible. In my observation in iritis atropine acts much more quickly after leeching the temple than if the temple were not leeches. We also get the results of mercury in these cases much more quickly after leeching than without it. The value of leeches in these and in other acutely inflamed conditions of the deep structures of the eye cannot be over-estimated, and in such cases no harm ever follows their use. The natural leech, in my experience, is much more effective than the artificial one. Atropine should be regarded as purely prophylactic and not curative. All we expect from it is dilatation of the pupil, so that adhesions may not occur in a contracted pupil, or if they do occur thus, that the dilating of the pupil may break them down when the patient is under the influence of mercury. If the patient has been well under the influence of mercury for six days, and at the end of that time if the pupil has not dilated under atropine, we may cease using it. After that period it will certainly not succeed in dilating the pupil and can

be of no useful service I fear that atropine is much too often regarded as curative and harmless, and that it is instilled in routine fashion when there is no hope of its causing dilatation of the pupil Mercury in some of its forms is the only drug we can depend upon in almost all of the diseases of the deep structures of the eye which are curative There are people who hold a different opinion, but such is my experience Chemosis, if it exists, should be freely scarified. An iritis or irido-cyclitis, if thus promptly and vigorously treated, will generally recover, though enduring adhesions of the iris to the after-cataract are not infrequent

Prolapse of Iris —Prolapse of the iris is seldom associated with much pain. It is always associated with some pain, and a considerable sense of discomfort As soon as possible after its occurrence, some advocate opening up of the wound and replacing the iris or excising a portion of it These measures, in my opinion, considerably increase the chances of infection The portion of the iris implicated is inflamed and is adherent to the surrounding structures, thus shutting up the aqueous chamber It is ballooned out with the intraocular pressure of the aqueous humour The eye generally recovers except for the prolapse if left alone After a few days the eye being cocaineized and the conjunctival sac well flushed out with an antiseptic solution, the assistant having charge of the eyelids, the operator should steady the eye and, if necessary, put some pressure on it with toothed forceps so as to cause the ballooned iris to become tense He should then drop astide it a good pair of iris scissors and cut it off close to the sclero-cornea and release the eye and dress it up When this is done, the sclero-corneal wound drops together and the case does well If a bead of vitreous escape, it is of no importance It may be observed in such cases that the pupil is often drawn up to an objectionable degree If so, an iridotomy should be done opposite the original sclero-corneal wound, either with a sharp knife as described in the chapter on after-cataract, or a small wound may be made in the sclero-cornea opposite the

original scar and a hook inserted on the flat until it is beyond the free edge of the iris and then twisted with the point downwards to catch the iris and drawn back, then twisted again on the flat so as to admit of it escaping from the wound. When the portion of iris is out of the wound, a small iridectomy or an iridotomy may be done, taking care to replace the remaining iris. I personally prefer a small iridectomy to an iridotomy in these cases. I prefer the hook for drawing out the iris in these cases to forceps, as it is exceedingly difficult to catch such irides with forceps in practice.

Purulent infection of the wound and of the deeper structures —In my observation, once purulent infection sets in, it progresses in spite of all our efforts. If it be of the wound merely, the thermo-cautery or, what is equally effective, a fine point of a nitrate of silver stick may be run along the wound, once it is seen that it is going to progress in spite of such measures, the sooner the eyeball is enucleated, the better.

Detachment of the Retina —I have seen very few cases of detachment of the retina occur after cataract operations. When they do occur, it is generally within the first ten days. The following case is an example. A. B. complains of some pain four days after operation, his eye was inspected and everything including vision seemed doing well, a few leeches were applied to his temple and a laxative of Pil Hydrarg administered. This relieved the pain, on the seventh day his eye was again inspected, an extensive detachment of the retina above was evident to the naked eye, and vision was proportionately diminished. Mercury was administered freely, and at the end of three weeks the retina had resumed its original position and vision was discovered to be good. He insisted on leaving hospital then, having made up his own mind that all was right. He returned three months afterwards, in the meantime the detachment had recurred more extensively, and the eye had become soft. I think, if he had remained at rest in hospital and been longer

under mercurial treatment, the detachment might not have recurred

These cases of detachment of the retina need not therefore be regarded as absolutely hopeless

Detachment of the Choroid—Detachment of the retina is not associated with hæmorrhage When the retina is detached, there seems to be between it and the choroid a serous effusion Detachment of the choroid is associated with free bleeding which makes its way out of the wound. I dealt with the prophylaxis of this condition in a previous chapter When detachment of the choroid occurs immediately after operation, the patient suddenly complains of sharp pain in the eye, vitreous begins to flow out and continues till it is all or practically all out, and then blood flows out freely, and in some cases, will continue to flow until the patient may be in an alarming condition from loss of blood I have seen cases reported in which this detachment was attributed to the loss of vitreous, whereas in reality the loss of vitreous was due to the pressure of the hæmorrhage behind the detached choroid Detachment of the choroid generally occurs between half an hour and two hours after operation Its occurrence later than two hours after operation is exceedingly rare In extraction in the capsule it occurred four times in my last thousand cases (unselected cases)

One of these four cases was in an eye which had suffered from glaucoma, which had left not much visual function behind it and in which an iridectomy had been done for the glaucoma six months previously The tension of the eye at the time of operation was nearly normal The eyes in the other three cases were to all appearance normal, except for the presence of cataract, escape of vitreous in my observation does not seem to have much to do with this complication The indication that detachment of the choroid is about to occur after the patient has left the table is the onset of the form of surgical shock which follows operations on the eyeball, the patient feels thirsty, he feels his head 'swimming' and dizzy He obtains a drink, if he can, and he

vomits—a condition not unlike sick headache—and then commences the free and prolonged bleeding from the interior of the eyeball. The nurse in attendance should be conversant with these symptoms and their meaning. The patient should not have any drink given to him as it contributes to vomiting. A hypodermic of a third of a grain of morphia should be administered on the onset of thirst—the first of the symptoms. This will generally control the thirst and the other symptoms of shock, the case will then generally do well.

In nervous patients and in those with rigid arteries a hypodermic of morphia on the operating table is a valuable prophylactic, once hæmorrhage has set in, the sooner the eyeball is enucleated, the better. It is necessary to enucleate it in some cases to control the hæmorrhage. If there is any hope for a case with detachment of the retina, there is none for a case of detachment of the choroid.

Post-Operative Glaucoma—This is a condition which usually sets in between the tenth and the twentieth day, generally nearer the tenth than the twentieth as soon as the wound has become soundly healed. The performance of an iridectomy at the time of operation in my observation has no prophylactic influence on this complication. It occurs generally in patients suffering from gout, or the diabetes of advanced life, or a combination of these diseases. The operator would thus do well to not lose sight of such patients for three weeks after operation. There may be no iritis, nor iridocyclitis associated with it, nor any other apparent intra-ocular inflammation. It seems to be a simple acute glaucoma. The patient complains of all the symptoms of ordinary acute glaucoma, the tension is increased.

A few leeches to the temple and a mercurial purge should be administered without delay. The patient should be kept in a darkened room. If, at the end of twenty-four hours after this treatment, there is no improvement, the aqueous chamber should be tapped by puncturing the sclero-cornea with a Graefe's knife. This tapping may be repeated every

second day for three or four times without fear. If a little vitreous escapes on such tapping, it is of no importance. Under this treatment the case generally does well. The following case will be of interest.—Six years ago I extracted the lens in the capsule of a wealthy native Indian merchant of about seventy years of age. He suffered from both diabetes and gout, he was very corpulent as is usual with his class. I did an iridectomy at the time of operation. There was no escape of vitreous or other complication at the time of operation. Everything progressed entirely favourably till the fourteenth day, when he sent for me complaining of pain. On arrival I found him suffering from acute glaucoma. He had religious objections to the use of leeches. His digestive system would not admit of purgatives. I tapped the aqueous chamber as above described three times at intervals of two days. At each tapping a bead of vitreous escaped. The eye recovered, and to-day the vision of that eye is as good as I could have hoped for it to be if glaucoma had not occurred.

Late Pain—Pain of a severe nature occasionally sets in about eight days after operation for which there is no evident cause. The eye looks “angry” and congested. There is no increase of tension. A few leeches to the temple and a mercurial purge generally controls this condition. If it continues after the leeches and mercurial purge, 5 grains of phenacetin or 5 grains of phenalgin three times daily for a few days, controls it, after which all goes well. 30 grains of salicylate of sodium four times daily has a powerful influence over it.

I advise patients to not use the eye for accurate work and to not allow glare to cause him inconvenience for three months as such is liable to set up acute congestion and much pain.

CHAPTER VIII

AFTER-CATARACT AND ITS TREATMENT

THIS is one of the evergreens of ophthalmic surgery. There is seldom an annual meeting of the ophthalmologists of any country at which it does not constitute a subject for discussion in some form or other—either the treatment of after-cataract, or how best to minimise the opacity of after-cataract by prevention, or how best to mature immature cataract and the stage at which immature cataract may be extracted so that the after-cataract may not be of very objectionable density. An after-cataract may consist only of the capsule left behind in the capsulotomy operation for cataract. In my opinion (and I have ascertained it is also the opinion of many of the leading ophthalmologists who operate for cataract), this minimum after-cataract is never absent, never transparent, never absorbed after the capsulotomy operation for cataract, and is never a negligible quantity from the patient's point of view, if he is desirous of obtaining the maximum vision possible. I hold, therefore, that treatment of the after-cataract is part of the operation for cataract by the capsulotomy method in all cases, and I am pleased to find that many of the leading men agree with me on this issue and follow this practice.

But after-cataract may be and often is much more dense than that just described. It may consist, if a cataract has been operated on in the immature stage, of the capsule and its cell proliferation and some of the lens matter so often left behind in those cases, or it may consist of capsule and lens matter left behind after operation for ripe cataract without cell proliferation of the capsule. These two latter varieties of after-cataract leave the surgeon no option but to operate, as they leave the patient very little vision owing to

their opacity With these two later varieties of after-cataract a severe form of iritis is frequently associated, a form of iritis which binds down the margin of the iris partially or entirely to the after-cataract and which constitutes the treatment of such after-cataract, a thing which no surgeon undertakes with a light heart The forms of iritis which follow the capsulotomy operation for cataract are due almost, if not entirely, to the capsule and lens matter which are left behind in that operation This is becoming the accepted theory of the present day, but how will any opponent explain the fact that iritis hardly ever occurs when cataract is extracted in the capsule with or without iridectomy! It is inexplicable on any other grounds

I wish here to draw attention to the method of estimation of the vision of illiterates (as has to be done frequently in India) This is necessary as I know that somewhat vague ideas prevail on the subject, for example, I have known results recorded in the following manner —the ordinary Roman test type was filled out in black squares and these were regarded as type for the corresponding distance Vision of $\frac{6}{8}$ has been published on this principle after the capsulotomy operation without needling of the after-cataract Let any one try the method with his normal eye and he will find that such a record would be correctly represented as $\frac{6}{1\frac{1}{2}}$ If bull's eyes are used placed at one diameter from one another and of the size which the normal eye can count at the same maximum distance at which it can read with equal ease the Roman test type, there is no finer test for vision than such bull's eyes It will thus be seen that records of vision are of little scientific value unless a full detail of the actual test to which the patient has been submitted, are given

I know that many ophthalmologists will not agree with me when I say that without treating the after-cataract vision better than $\frac{6}{1\frac{1}{2}}$ when the patient is leaving hospital is seldom obtained, and this $\frac{6}{1\frac{1}{2}}$ will fall to $\frac{6}{2\frac{1}{4}}$ at the end of

six months, such vision is of course very useful, but for fine work is useless

Many of the advocates of Daviel's operation have a tendency to make little of after-cataract and its treatment

An intelligent patient does not make little of either. He often tells us that the eye in which there is an after-cataract constantly reminds him of its existence. He feels it tender when he sneezes, coughs, or strains at stool. We know that such eyes are liable to serious intraocular trouble on the slightest provocation—provocation which would not influence the normal eye or an eye from which the capsule had been removed. The after-cataract has no function in nature to perform and nature seems to resent the presence of this body which is akin to a foreign body.

Neither does the patient make little of the operation or the number of operations he has to undergo for its treatment. The surgeon who is proceeding to perform the capsulotomy operation should invariably warn the patient that shortly afterwards he will require to have a further operation done for the after-cataract. Nothing is more depressing or more disappointing to a man who has not been thus warned than to be told afterwards that he must have a further operation performed before he can see properly. He feels that his hopes are blasted, he is not at the time of life when his nerve is at its best, and if not thus warned, he not uncommonly prefers to spend the remainder of his life in partial darkness than to submit to a further operation for his after-cataract. I have known men in important public positions who, when they found that this further operation was necessary in what were beautiful results of the capsulotomy operation, preferred to plod on and do their work through an assistant who reads to them and writes for them by dictation rather than submit to any further operation. To us this may seem absurd, nevertheless, it is an important reality with which we are face to face, hence we must take men as they are.

The unprecedented progress of the ophthalmic side of the Jullundur Hospital in which there are now between 2,500 and 3,000 cataracts done yearly is, in my opinion due chiefly to the absence of the after-cataract (extraction in the capsule) with a mortality of eyes well under one per cent from all causes, and the stationary position of the numerous hospitals in India, (a country in which there are upwards of 25,000 cataracts extracted yearly) which are manned by as competent and as zealous ophthalmic operators as there are in the world, is in my opinion due to the presence of the after-cataract which invariably follows the capsulotomy operation, and to the complications associated with tags of capsule in the wound. These operators are as careful in the selection of their cases as we are in Jullundur and they are as careful about aseptic and antiseptic precautions as any other surgeons.

We see it commonly assumed that a surgeon can cut up a native of India as he likes and that he will recover all the same. On the contrary, we Anglo-Indians know that he is no better subject for operation than the European.

It is also a common assumption that the people of India will be content with any result in surgery, ophthalmic or general, those who base arguments on this assumption are building their house upon the sand. In my experience the peasantry of India are about as exacting as regards the visual results of cataract operations as any people in the world.

I have had the opinions of a number of experienced Anglo-Indian operators on this matter, and the conclusion we came to was that the stationary position of the Indian hospitals in which the capsulotomy operation is performed is due to the fact that it is a hard struggle for the capsulotomy operation to hold its ground against the itinerant lens coucher's operation.

Taken all over the Indian Empire, the capsulotomy operation is followed by total failure ["discharged otherwise"] in about 14 p. c. of the cases.

The lens coucher's operation is probably followed by a greater mortality of eyes, but the capsulotomy operation without needling of the after-cataract—the peasant does not like more than one operation for cataract, and very seldom submits to needling of his after-cataract—gives poor vision, whereas in the successful cases of the lens coucher's operation vision is ideal, as far as vision following a cataract operation can be ideal, for some time. The invariable progressive atrophy of the retina, which follows couching of the lens later on, the peasant does not attribute to the operation.

Treatment —When we examine the writings on this subject and we observe the multiplicity of proposals, all apparently satisfactory to their authors, we easily come to the conclusion that none of them can be satisfactory.

They all aim at tearing a hole in the after-cataract and leaving the offending body in the eye.

There are three procedures for the treatment of after-cataract —

- (1) Needling
- (2) Couching
- (3) Extraction

For needling, couching, or extraction, the eye should be prepared as for a cataract operation. It should be well under the influence of a mydriatic, atropine if under 20 years of age, homatropine if over 20. Under 20 years of age there is no objection to the free use of atropine.

Needling, couching and the incision for extraction are most conveniently done with the speculum in position.

(1) For needling in my experience the best instrument is a Graefe's knife with a narrow blade, really sharp for about $\frac{3}{16}$ of an inch from the point, from which distance backwards it should be ground so blunt that it will not cut the cornea. The eye should be steadied with the toothed forceps; the knife should be inserted on the flat below near the sclero-corneal margin, and driven through till the point of it is just beyond the centre of the pupil. The knife should

then be driven through the after-cataract at one side and made to cut right across to the other side, using the corneal puncture as a fulcrum while so doing and then withdrawn. The case should be dressed up and seen daily

During this procedure an assistant should concentrate a good light on it through a convex lens, so that the operator may see exactly what he is doing. After a few days it may be seen that the opening in the capsule has partially or, it may be, completely closed again, in which case the operator may have to repeat the procedure. If so, he should insert the knife in a similar position, but 90° from the first puncture. He should cut each half from the periphery towards the centre of the pupil, which implies that when he has cut one half, he should rotate the knife on its long axis through 180° and repeat the process with the other half, withdraw it and dress up the eye. This cut being at right angles to the original one, it will be found that the knife cuts better from the periphery towards the centre of the pupil than *vice versa* for an obvious mechanical reason.

The eye should be carefully watched for a few days for any indications of iritis or increase of tension after any needling operation.

It may be asked why not make this crucial incision at one sitting. My reply is that when you have withdrawn the instrument from one puncture in the cornea, the aqueous humour will have escaped, and you will have considerable difficulty in immediately reinserting it, and in completing the crucial incision, whereas a few days afterwards this trouble will not be encountered, the tension of the eyeball having become re-established.

(2) Needling is only suited for thin after-cataracts not complicated with adhesions of the iris thereto. For dense after-cataracts we must either couch or extract. For couching, the operator should make a puncture with a Graefe's knife close to the sclero-corneal margin below and pass through it the triangular point of a probe of about the same dimensions as the full-sized probe in an ordinary

surgeon's pocket dressing case until the point is close to the opposite side of the eye between the iris and the after-cataract. Then using the corneal puncture as a fulcrum, he should depress the point of the probe, drawing it a little out as he depresses it until he has turned it and the after-cataract well behind the iris below, having a good light concentrated through a convex lens on it during this procedure so that the surgeon may see exactly what he is doing. If necessary, he should make the point of the probe perform a sweep behind the margin of the pupil on both sides, so as to make sure that he has detached most of the after-cataract. This operation is not suited for those cases, and they are many, in which there are adhesions of tags of capsule to the sclero-corneal scar, or to cases in which there are adhesions of the iris to the after-cataract. These cases are only suited for extraction.

I have couched a considerable number of dense after-cataracts, and the results seem to be very satisfactory, but from my observation that, even in the most successful cases of couching of the cataractous lens, progressive atrophy of the retina invariably follows (*vide* Chapter on lens couching), I have doubts whether similar atrophy may not eventually follow couching of the capsule, and for this reason it is a proceeding which I do not recommend.

(3) Extraction of after-cataract is the soundest of all these procedures for all cases, it is simple, it is effective, it is done at one sitting, it removes the offending and functionless body and leaves the patient in the position of a man who has had his lens extracted in the capsule, other things being equal.

In the case of dense after-cataract, whether the iris be adherent to the after-cataract or not, and in those cases in which the capsule is adherent to the sclero-corneal scar, extraction is, in my opinion, the only efficient proceeding.

In my observation the margin of the iris is very often adherent to dense after-cataracts, either partially or extensively. At the present time there is great hesitation in touching after-cataracts to which the iris is extensively

adherent, and those to which its margin is adherent all round are generally regarded as inoperable

The following case illustrates this point Mr C. D., five months after having his cataract extracted by the capsulotomy method with an iridectomy, came to me He had a dense after-cataract as opaque as the original cataract The pupil was of normal size, the perception of light was good, the margin of the iris was bound down to the after-cataract all round, and tags of the after-cataract were adherent to the sclero-corneal scar He had evidence of inflammation of the ciliary region at that time He had steadily continued the free use of atropine from the time of operation—the most misused drug in the Pharmacopœia

The operator and his colleague informed him that nothing more could be done He had not at any time been treated with mercury nor had leeches at any time been applied

In order to reduce the inflamed condition of the ciliary region, I put him well under the influence of mercury and applied leeches to the temple once a week for about four weeks, at the end of this time the inflammatory condition had subsided During this period he used, of course, no atropine

During the 24 hours before operation the patient being well under the influence of mercury, the eye was atropinized four times, so that the atropine would be able to act when the iris would be released

Just before operation I applied six leeches to the temple, all with the object of anticipating a sharp attack of iritis which I expected to follow the operation I made a full-sized iridectomy incision in the sclero-corneal margin partially over the region of the original iridectomy and partially over the iris, so that I would be able to excise a further piece of iris if necessary

The instrument I use for detaching the iris from after-cataracts has a handle the same as a Graefe's knife and is mounted at one end by a curved, blunt-pointed, stout steel

probe, curved from the end backwards for about half an inch to a circle of $\frac{3}{4}$ inch in diameter. Without taking out any more iris, I tried to get the point of this instrument between the iris and the after-cataract, but could not do so as it was adherent not only all round, but also to the margins of the original coloboma. I then took out a small piece of iris which admitted of my instrument being inserted between the iris and the after-cataract. In these cases there is generally a small circle of posterior chamber containing aqueous and the iris is thus adherent only at the pupillary margin. My assistant at this stage having charge of the eyelids as in extraction in the capsule, I passed the instrument between the iris and the after-cataract through the iridectomy I had done and detached it little by little all round. Some bleeding from the iris of course followed—bleeding always follows any such rough handling of the iris, I massaged out the blood until bleeding ceased. I then put in a pair of iris forceps closed to well beyond the centre of the pupil, allowed their points to open wide, drove them well through the after-cataract and brought out the whole after-cataract, there was no escape of vitreous. The eye was dressed up. Next day I was pleased to find the pupil dilated and that there was iritis though not severe, the iritis cleared up in a few days under the influence of the mercury which he continued to take and without any more atropine than had been instilled the day before operation. At the end of a week the eye was all right and with a moveable iris once more.

His distant vision is now $\frac{6}{6}$ and for near vision Jaeger II with spectacles, and he has ceased to feel the sense of pain and discomfort in that eye which had worried him ever since the original operation. He is one of the most grateful patients I have ever had.

The proceeding which I adopted in this case would, I am aware, be generally regarded as reckless daring, but I have experience enough of it to be able to confidently recommend it, and in such cases there is no alternative

but blindness I have done it often and have never had reason to regret such action

In ordinary cases of dense after-cataract without adhesions of the iris, the same procedure should be adopted with or without an iridectomy at the same time. When tags of capsule are adherent to the sclero-corneal par, the operator should be careful to make his incision in a position which will afford him facility for grasping those tags if necessary. If the eyelids are properly looked after by the assistant, vitreous should seldom escape in this operation, and when it does escape, it should not exceed a bead. This should be snipped off, a bead of vitreous is of no importance

Mercury and leeches are only necessary when there is a special indication for them. At the time of operation atropine or hamatropine is always necessary

This procedure is not accepted or practised by ophthalmic surgeons except myself, as far as I know, on account of the fear of the escape of vitreous and the consequences thereof. On this issue I invite the attention of the reader to the chapter in this monograph on escape of vitreous by Captain Lister, which demonstrates that escape of vitreous within reasonable limits has no ulterior consequences. Those who talk about the evil results, seldom, if ever, give us carefully detailed figures of cases followed up, to demonstrate the grounds of their fear. They hand down a doctrine which has never been seriously challenged or examined and the cases reported are almost, if not all, of the following nature. After the lens has been extracted in the capsule and before the patient has had time to be removed from the table, for no evident reason vitreous begins to flow out *freely* and immediately free bleeding follows, this is called detachment of the retina—it would be more correctly termed detachment of the choroid—and this detachment is attributed to the escape of vitreous, whereas the escape of vitreous is due to the detachment, this I have frequently observed and I invite the serious attention of ophthalmologists to this fact.

The readers who accept my facts will agree with me that there should be no after-cataract to treat (children and juveniles excepted) But if such does exist, that it should be extracted.

CHAPTER IX.

COMPARISON OF THE INTRACAPSULAR AND THE CAPSULOTOMY OPERATION FOR CATARACT.

IN comparing the relative advantages and disadvantages of these two operations, it is necessary to consider them both from the following points of view :—

- (1) Simplicity
- (2) Incidence of escape of vitreous and its relative importance in either operation
- (3) Incidence of detachment of the retina following either operation
- (4) Incidence of detachment of the choroid following either operation
- (5) Iritis and irido-cyclitis
- (6) Incidence of sepsis
- (7) The relative amount of astigmatism
- (8) The relative visual results
- (9) The after-cataract

(1) The capsulotomy operation is undoubtedly incomparably more simple than the intracapsular operation

Simplicity is certainly a claim to superiority if results are equal in the two cases. If results are superior in the more difficult operation, simplicity can only be considered, if skill in the more difficult operation is entirely beyond reach of acquirement. Anyone who is placed in the latter position as regards cataract, I would advise to perform the capsulotomy operation. If results in the intracapsular extraction are better, the difficulty of that operation is a substantial reason why operators should learn the art from practical instruction on the living subject by a master of that art and not from mere written descriptions. The capacity of language is limited, what artizan learns his art from mere

written descriptions? The man who proceeds to shoe horses, for example, from mere written descriptions of that art will lame many horses before he succeeds in shoeing them properly. If it is necessary to learn such arts by practical demonstration, it is surely not less necessary to learn the art of operating on the human eye similarly.

(2) *Escape of vitreous*—The advocates of the capsulotomy operation admit the occurrence of escape of-vitreous in about 5 p c of their cases. In my hands at the present time it occurs in a fraction over 5 p c of my cases of extraction in the capsule done as a systematic operation without selection.

In the intracapsular operation it will undoubtedly occur more frequently in the hands of beginners, but if they are taught by an experienced operator, it should not occur with much more frequency, for example, A B (a beginner) extracted before me over 400 cataracts in the capsule, escape of vitreous occurred in a fraction over 5 p c. At first I selected easy cases for him, but later on he did them without selection, he lost one eye out of the above number from all causes, what he could do, anyone else should be able to do under similar conditions.

Escape of vitreous in the capsulotomy operation is a more serious complication than in the intracapsular operation. In the intracapsular the whole of the offending body is removed, in the capsulotomy when vitreous escapes, the lens capsule is partially dislocated and is left behind with a considerable amount of lens matter which causes iritis and irido-cyclitis. The intracapsular operation with escape of vitreous is devoid of this complication. Anyone who reads the appendix to this monograph will see that a moderate escape of vitreous is not followed by deleterious results, this fact I have urged for several years past.

(3) *Detachment of the retina* immediately following either operation is so rare an occurrence that it may be neglected in the comparison of these two operations.

Complex or late detachment of the retina follows the capsulotomy operation more frequently than the intracapsular operation. By complex or late detachment I mean detachment which is due to the contraction following an irido-cyclitis which draws the ciliary body and retina out of their bed long after the extraction of the lens. This form of retinal detachment is of itself of no importance as the functions of the eye have been destroyed before the occurrence of the detachment by the irido-cyclitis.

(4) *Detachment of the choroid* occurs with about equal frequency in either operation in my experience. Its occurrence depends on other conditions than on the operation selected, such as glaucoma and post-operative shock, etc.

(5) *Iritis and irido-cyclitis* occur with incomparably greater frequency after the capsulotomy than after the intracapsular operation.

I think I am not overstating the case by saying that one or both of these conditions follows in about 10 per cent of the cases after the capsulotomy operation and is well under 1 p c after the intracapsular. Both my adherents and opponents with some experience of the intracapsular operation admit the extreme rarity of iritis and irido-cyclitis following this operation as compared with the capsulotomy operation.

Under the term iritis I include all iritic trouble except prolapse, though I am aware that many operating ophthalmic surgeons do not use the term in this extensive sense and thus their percentage of iritis is much smaller than it should be. They include much under the term "irritation of the iris" which I include, and I think rightly, under the term "iritis."

In two large Indian hospitals I have endeavoured to find the percentage of iritis in the capsulotomy operation, but they steadfastly refused to give their statistics to me. Published statistics of reasonably large figures are not available as far as I know.

Any one familiar with the after-treatment of cataract operations will appreciate the importance of the practical

absence of these complications in the intracapsular operation I read a paper at the annual meeting of the British Medical Association at Swansea, 1903, in which I discussed the causation of iritis following cataract extraction. Apart from gross sepsis, the view then held by ophthalmologists the world over was that it was due to bruising of the iris by the escaping lens. This view applied to the capsulotomy operation as at the time there was no other operation in the field. I argued from the fact that when the lens was extracted in its capsule with or without an iridectomy and without atropine that there must be much more bruising of the iris than when the lens is taken out piecemeal by the capsulotomy operation, and that when iritis hardly ever follows extraction in the capsule, the theory then current must be absolutely wrong.

I further put forward that the iritis following the capsulotomy operation could only be due to the consequences of leaving lens matter and capsule behind and not to the bruising of the iris. I am pleased to see that the views I then put forward, based on practical facts, are now becoming accepted the world over. The result of this is that at the present time more weight is attached to the thorough removal of lens matter and as much of capsule as possible in the capsulotomy operation, by those who perform the capsulotomy operation than formerly was the case.

(6) *Incidence of sepsis* —To compare the two operations in this respect it is necessary to deal with Indian Statistics.

We are thus dealing with the same people operated on under similar conditions—conditions very much more unfavourable than those which hold in Europe and America. In India trachoma is exceedingly prevalent, and in that country it is, I think, usual to operate for cataract on patients with more or less trachoma, at least such is my practice. Such patients do not stay with us in India long enough to have their trachoma properly treated before operation. If we detain them long for this purpose, they leave us and go to the immemorial lens coucher.

I observe that in the annual reports of the Charitable Dispensaries of India (reports purchasable from the Indian booksellers in London) the mortality of eyes which have been operated on for cataract by the capsulotomy method is as high as about 14 p c, whereas in extraction in the capsule at Jullundur my loss of eyes from all causes since I commenced extraction in the capsule stands well under 1 p c. My opinion is that this relatively low mortality of eyes is the reason why the Jullundur Hospital, in an overgrown agricultural village without prestige and with a very meagre staff and meagre finances, has grown from almost nothing to be as large as the next five largest ophthalmic hospitals in the world.

The peasantry of India are not only not fools, but are about the most highly utilitarian people in the world. It matters nothing to them from what cause an eye is lost, news travels amongst them by their own primitive agency almost as fast as if there was a free telegraph office in every village. They discuss all hospital matters around the village hookah (tobacco pipe) with an appreciative knowledge which is not excelled by any peasantry in the world, and at such sittings the estimates of the different hospitals are formed on results and results alone—the cases lost and the relative vision of those not lost.

What explains this difference in the amount of sepsis which follows the capsulotomy and intracapsular operation? The capsulotomy operators of India are what in Europe and America would be called highly experienced operators, they are as careful in eliminating anything which would contribute to sepsis as I am. In my opinion the difference is due to the inevitable consequences of the capsulotomy operation, *i e*, the unavoidable introduction of a number of instruments into the interior of the eye, to lens matter and capsule left behind and not least to tags of capsule left hanging in the wound which form a drain admitting sepsis. Such tags of capsule in the wound act as a sort of foreign body, they for some days seem as slow to unite with it a piece of gauze.

The advantages of an operation eliminating these factors is self-evident

(7) *Astigmatism* —There is as much astigmatism after the one operation as after the other. Why should it be otherwise? Astigmatism depends on the incision

Astigmatism in the intracapsular operation in my experience ranges between 0.5 and 1D in the average

(8) *Visual results* —In the capsulotomy operation without treatment of the after-cataract a high average would be $\frac{6}{12}$, at the end of the three months $\frac{6}{18}$, and at the end of 6 months $\frac{6}{24}$, with suitable spectacles. Occasional cases may be better than this, but at least as many will be much lower than this standard. Such vision is useless for fine work. After the after-cataract has been needled, provided that it admits of being needled successfully, which is by no means always the case, as in the cases I have mentioned previously, a vision of higher than $\frac{6}{9}$ is very rarely obtained. The average resulting vision is nearer $\frac{6}{12}$ and often much less than this.

Assuming the eye to be normal apart from cataract at the time of operation by the intracapsular method, a month after operation the vision should average $\frac{6}{9}$ with suitable spectacles. The ultimate vision is very much higher than this, often as high as $\frac{6}{35}$, as will be seen in some of the cases given in the appendix, in which escape of vitreous had occurred. Such vision obviously is sufficient for the finest of work, and puts the patient in as favourable a condition as regards sight as he was before operation.

(9) *After-cataract* —To improve the vision after the capsulotomy operation, it is necessary to operate on the after-cataract *invariably*. This introduces these patients to a second operation which is not always satisfactory and which, as usually done, leaves the offending body in the eye. The capsule when left in the eye, whether needled or not, is not an innocent body. It has no function in nature to perform when needled, not even the questionable function of being a diaphragm. Nature often seems to resent its presence.

as indicated by the greater liability of such eyes to iritis or irido-cyclitis from trifling causes which do not lead to such conditions in the normal eye or in the eye from which the lens and capsule have been removed.

CHAPTER X

THE ASSISTANT

THERE is no operation in the whole range of surgery in which the assistant plays so important a part as in extraction of cataract in the capsule. In that operation his province is quite limited but that he should be thoroughly efficient is no less important than that the operator himself should be thoroughly competent. Other things being equal, escape of vitreous will be rare or frequent in that operation according as the assistant is competent or the reverse.

When I commenced teaching men the art of extracting cataract in the capsule by demonstrations on the living subject, they left me thinking it very simple. I found that when they tried it on their own cases, they found it quite otherwise. I then commenced to make them operate before me, either my assistant or myself acting as their assistant. I observed that under these circumstances after a short time a reasonably dexterous man becomes a thoroughly efficient operator. I also found that in order to enable such men to train their own assistants rapidly, it was advisable to make them do the assistant's duty for me.

An assistant is not efficiently trained by assisting at 20 cataract operations—100 would be nearer the requisite number.

It will thus be seen that those who operate from a written description with an unskilled assistant on a small number of cases of extraction in the capsule, are operating under very difficult conditions.

APPENDIX

The after-effects of escape of the vitreous, during the operation of extraction of cataract in the capsule by Smith's method with a tabulated statement and analysis of 98 cases in which escape of vitreous occurred

BY CAPTAIN A E J LISTER, M B . B S (LOND), I R C S
(ENG), I M S

In the various discussions which have taken place from time to time, as to the advantages and disadvantages of this operation, it has been contended by the opponents of the operation for the extraction of cataract in the capsule, that one of the chief objections to this operation is the frequency of the escape of vitreous. This being the only complication, which is at all frequent, and the one which is most commonly met with by beginners in this operation, I enquired from Major Smith on my arrival in Jullundur in 1906, if any series of cases had ever been published, in which the after-effects of escape of vitreous in this operation were given. Major Smith informed me, that as far as he was aware, no such series of cases had ever been published, either after this, or the capsulotomy operation.

I then offered to undertake a research into the subject and received permission from Major Smith to make every use of his hospital records which were placed at my disposal for this purpose.

Every assistance was rendered me by Major Smith, whom press of work alone had prevented from carrying out this work before. Many thousands of cases in the operation books were gone through, and the names of patients, in whose eyes escape of vitreous had occurred, were noted. Each patient was then written to, and of them 95 presented them-

selves for examination. In certain of the tables it will be seen that the amount of vitreous and the remarks made at the time of operation are not given. The reason of this is, that in the operation book a note only was made of the fact that vitreous had escaped, the details are noted by Major Smith on the patients' tickets always under four headings —

- (i) Drop = 2 to 4 minims
- (ii) Trace = 4 to 5 „
- (iii) Slight = 5 to 10 „
- (iv) Some = 10 minims to one-third of the vitreous.

The cases will be found classified in the tables appended under these headings

As the cases went back as far as nine years, it is not surprising, considering the many thousands of hospital tickets there were, that all the tickets could not be found. Native patients are very apt to take the ticket home with them when they go, and in a large hospital with many hundreds of patients and a very small staff, such as there is at Jullundur, it is not always possible to prevent this. Some patients being satisfied with their condition do not wait to be discharged but depart, taking the tickets with them. These facts will be well known to surgeons in India, but they are mentioned to make the matter clear to any who do not know India. Three were found to have had escape of vitreous in both eyes, so the number of eyes examined was 98. In 90 of these cases, no portion of the capsule of the lens was found to remain, in eight a portion of it or the whole was found to be present.

METHOD OF EXAMINATION

The vision of the patients was tested by Snellen's test types, if they were able to read, in the case of those unable to read, who formed the bulk of the cases, by groups of dots, which they were asked to count. Special test cards, with dots of various sizes, corresponding to Snellen's distant test types, were kindly supplied for this purpose by Messrs

Lawrence and Mayo of Calcutta I found it more convenient to cut out various groups of dots, and to mount them on cardboard, one or two for each corresponding line of Snellen's test types. When dealing with patients lacking in education and advanced in years, this plan will be found an advantage. I have many times tested the results given by the same people, when asked to read the Snellen's test types. I find that on the whole the dots are slightly the harder test of the two so that all the results given may be taken as absolutely correct.

I found the use of these dots more convenient than Landolt's optotype, which I also used for some cases. At first I endeavoured to test the vision with the glasses found by determining the refraction of each case by retinoscopy. I found after doing a number of cases that the astigmatism was scarcely ever over one diopter, so to save time I gave up doing a retinoscopy in every case, and gave them the plus lens they preferred, which in almost every case was a plus ten diopter lens. The excellent results obtained proved the correctness of my observation, as the results obtained were all without the use of cylindrical lenses. I have noted in the column of remarks, the cases in which a spherical lens other than +10.0 D was preferred.

The patients in most cases insisted on returning the day they arrived, so that on account of press of work, I was unable to do a retinoscopy in the majority of the cases. As excessive astigmatism has been alleged to be caused by this operation, it may be well to call special attention to these facts. I have also observed a number of cases in which escape of vitreous had not occurred, and I found that in them also the average astigmatism was one diopter. Owing to enforced absence on several occasions, twenty-five of the cases were kindly examined for me by Major Smith. I had also the advantage of the opinion of Major Smith on the few cases in which disease of the fundus was present, which will be mentioned later. The chief facts revealed by this research are as follows —

The total number examined was 98, in no case was any detachment of the retina present. Disease of the fundus was found to be present in 8 eyes. A detailed account of these is given elsewhere in this paper. The exact time which had elapsed since the operation was known in every case. It averaged 3.706 years.

The different periods since the time of operation ranged from six months to nine years.

VISION OF CASES

Tables will be found at the end of the paper giving the exact vision of each case, with one exception, in which by an oversight I forgot to note it at the time of examination. It may be wondered why the vision of the cases in table "A," does not quite correspond with those in table "B," being in the form shown chiefly as $\frac{6}{t}$, the answer is that at first I did not test a patient further if he had a vision of $\frac{6}{t}$. Later when I found what excellent vision they had, I endeavoured to estimate it exactly. It will be noted that the average standard of vision is very high indeed, thus in 61 cases in which there was no opacity of the cornea, capsule left behind, or disease of the fundus, the vision was as follows.—

$$\frac{6}{3} = 4, \quad \frac{6}{3.5} = 6, \quad \frac{6}{4} = 4, \quad \frac{6}{4.5} = 5$$

$$\frac{6}{5} = 4, \quad \frac{6}{6} = 3.3, \quad \frac{6}{8} = 2, \quad \frac{6}{9} = 3$$

I may remark here that I find in India, owing to, I think, the better light and clearer atmosphere, the patients who come to me for examination usually read a line or two more of the Snellen's test types than they do in England. I find very many British soldiers read $\frac{6}{3.5}$ quite readily. This may account to a certain extent for the excellent vision of these cases, but it is not the chief reason, which is the absence of an after-cataract, leaving a perfectly

free pupil and also the low degree of astigmatism. An important question is, does the amount of vitreous lost, exercise a marked effect on the vision obtained by the patient? The figures at my disposal are too small to admit of any definite conclusion, but they indicate, as far as they go, that it does not have any marked influence. Reference to the tables shows that it does not appear to have any marked influence. Thus we find in five cases in which the largest amount of vitreous was lost, the vision was —

$$\frac{6}{3}, \frac{6}{5}, \frac{6}{6}, \frac{6}{6} \text{ and } \frac{6}{9}, \text{ whilst in}$$

six cases classed as "*trace*" and "*slight*" in which an average of double the amount of vitreous was lost as in these cases we find the vision to be $\frac{6}{3}, \frac{6}{3}, \frac{6}{7}, \frac{6}{6}, \frac{6}{7}, \frac{6}{6}$.

The number of cases is far too small to be conclusive, but they are sufficiently striking to point out the need of further investigation on this point. Thus it does not appear from these cases that the amount of vitreous lost, provided that the eye recovers from the immediate result of the operation, is the important factor in determining the ultimate vision of the patient, that might be expected.

I repeat that the number of cases is too small to be conclusive, but they are sufficiently striking to call for further investigation, those operators, who have observed cases in which a large amount, *i.e.*, more than one-third of the vitreous, has been lost, will have noticed that the vision of such patients is often much worse at the time of leaving hospital, than the vision of those patients in which a smaller amount has been lost. I have had the opportunity of observing these patients in a number of cases after leaving hospital, and have come to the conclusion that the vision of these patients is eventually much better than one might expect at the time of their leaving hospital, this observation is in accordance with the above facts, and will be of interest to those who may

be intending to adopt the operation of extraction in the capsule I think it is due to the greater distortion of the cornea which results temporarily, and to the fact that the normal tension and conditions of circulation and nutrition of the eye take longer to be re-established after loss of the vitreous, than when it is not lost I have noticed this to be particularly the case in very old and feeble patients This fact may have led ophthalmologists who have not had the opportunity of seeing a large number of cases in which escape of vitreous has occurred, at a time when the eye has had sufficient time to completely recover, to regard escape of vitreous as more serious than this paper tends to prove it to be

CASES IN WHICH DISEASE OF THE FUNDUS WAS PRESENT

In 8 eyes of the 98 cases examined, disease of the fundus was found to be present It may be of use to future observers to mention these in detail They will be found in table "E" I will proceed to make a short comment on each —

Case 1, Table "E"—Is one of syphilitic disease of the fundus and needs no comment

Case 2, Table "E"—Presents the ordinary history and signs of malarial optic neuritis I have seen many cases with a similar history and fundus condition Major Smith says it is quite common in the Punjab and my smaller experience coincides with this

Case 3, Table "E"—Is an ordinary case of disseminated choroiditis As it was present in both eyes, and escape of vitreous only occurred in the right eye, it cannot be attributed to escape of vitreous fairly To discuss the question fully as to whether the condition of the fundus was caused by the extraction of the lens in its capsule as may be suggested by the opponents

of this operation, is beyond the scope of this paper. I will only say in passing, I do not think it was Disseminated choroiditis is so commonly seen in the Jullundur clinics, that I do not see any reason to connect it with the operation.

Cases 4, 5, and 6 —These were all cases in which the lens had been previously “*couched*” and presented the typical appearance of the condition, which always follows couching of the lens. This condition has been described fully in the medical press by Major Smith. It is interesting to note, however, that apparently in some cases at least removal of the lens does not prevent the progress of this serious condition.

Case 7 —Is a case of bilateral optic atrophy. Escape of vitreous occurred in one eye only, so it could not have been the cause of the condition in one eye and it is reasonable to assume it did not cause it in the other.

It may be said that the optic atrophy was caused by the operation for extraction of cataract in the capsule, in both eyes. The disease is such a common one in the Jullundur clinic in old men, that I think it is quite as reasonable to say it was unconnected with the operation as with it. This matter needs a separate investigation. It should, however, be noted here, in connection with this and the preceding case, that Major Smith always extracts a cataract if there is any hope of improving the vision for a time and that the condition may have been present in its earliest form at the time of operation.

Case 4 —The condition may possibly have been caused by the escape of vitreous, but when the facts are taken into account that the eye was operated on five years before and that the vision was $\frac{6}{16}$ when seen, and also that in no other case in the series has any effect been proved to have followed

escape of the vitreous, it seems that it is quite likely to have had another cause. On examining these cases critically, it will appear that the case mentioned last, case 3, table "E" only, may be due to escape of vitreous.

This condition, however, I have seen so commonly in the Jullundur clinic that I do not regard it as being due to loss of vitreous. Major Smith shares this opinion. I, however, leave the truth of this opinion for other observers to prove or disprove. It may be argued that the cause of some of these conditions may, if not loss of vitreous, be due to the disturbance of the conditions of the eye caused by the extraction of the cataractous lens in the capsule. This argument, I think, can only be advanced as regards cases numbers 3 and 4, optic atrophy and disseminated choroiditis are, however, very common conditions in patients attending the Jullundur clinic, and I regard these cases as attributable to ordinary causes, but on this point also, further investigation is required. We arrived therefore at the conclusions that of the series of 98 eyes examined, one case of retinal degeneration may possibly be due to loss of vitreous, or to the operation of extraction of the cataractous lens in the capsule, or to a combination of the two, and that one case of optic atrophy and one of disseminated choroiditis may possibly be due to extraction of the cataractous lens in the capsule. If we take the escape of vitreous occurring during this operation as being about 5 to 6 per cent in the hands of skilled operators, and allow that one case out of every 98 in which this accident happens, develops subsequent disease of the fundus, we arrive at the conclusion on the foregoing facts that loss of vitreous in this operation, provided the eye recovers from its immediate effects, is not the serious complication which it at first sight appears. It is interesting to note that this is the opinion arrived at by Major Smith from a general experience of these cases, apart from any definite research in this subject, some years ago.

It is especially interesting to note that detachment of the retina, the condition so generally feared as liable to occur

after escape of the vitreous, did not occur in a single case. I suggest in conclusion that those ophthalmologists who state that loss of vitreous is such a serious accident in cataract operations, have been guided by the facts as known to them in operations other than those in which the cataractous lens is extracted in its capsule. It is quite probable that the eye in these operations hampered with debris and the capsule of the lens, which, apart from those cases in which definite iritis occurs, must usually cause some degree of irritation, does suffer more serious damage, when loss of vitreous also occurs, than does the eye, which is free from any irritating material. The fact that the eight cases in which capsule was left, showed no disease of the fundus, is interesting, but it should be remarked that in only one case, viz. there a large amount of capsule i.e. case number ten, table C, the other cases having only a small amount, as Major Starb always endeavours to remove as much of it as possible. On account of having a large wound, it is possible to remove most of the debris so that the condition in these cases was not quite the same as it is in the ordinary capsulotomy operation.

Having regard to the facts given here I maintain that though the number of cases is far too small to be conclusive it is sufficiently large to make us hesitate before we accept any conclusions formed by ophthalmologists, who do not extract cataract by Smith's operation, as to the seriousness of loss of vitreous in this operation. Further investigation will doubtless throw more light on this important subject. I repeat however, let us be careful before we accept any dicta by any ophthalmologist, however distinguished he may be, on this important subject, unless supported by a series of cases, an account of the operation performed, especially a statement as to whether the capsule was left behind or not, and if iritis or irido-cyclitis followed.

AFTER-EFFECTS OF ESCAPE OF THE VITREOUS

BY CAPT A E J LISTER, I M S

TABLE A

Showing—

(1) Number of years since the operation

(2) Vision

(3) Amount of escape of vitreous

(4) Astigmatism

(5) Remarks noted on case sheet at time of operation

(6) Notes on points of interest in brackets in last column

Number of cases—36

Number.	Name	Years since operation	Vision	Amount of escape of vitreous	Astigmatism	Remarks at time of operation
1	Khara	5		Trace	.	Iridectomy
2	Akho	4		"		Iridectomy "Very Nervous"
3	Har n a m Singh	5		"		Iridectomy Lens lifted on spoon

Number	Name	Years since operation	Vision	Amount of escape of vitreous	Remarks at time of operation
1	Kara	6		Slight	Slight escape of vitreous No iridectomy He shot out lens and some vitreous on completion of incision from nervousness
2	Bhagwan	2		"	Iridectomy Lens extracted on spoon
3	Dan	5		"	No iridectomy

Number.	Name	Years since operation	Vision	Amount of escape of vitreous	Astigmatism	Remarks at time of operation
1	Mammon	1		Drop		Iridectomy
2	Fata	1		"		"
3	Tabo	1		"		"
4	Deva Ditta	2		"		Lens dislocated by "rawal".
5	Jhandoo	7		"		Iridectomy
6	Fateh Din	5	$\frac{6}{3.5}$	"	+0.75 D cylinder	Very nervous patient
7	Achroo	1	$\frac{6}{4.5}$	"		Iridectomy

Number	Name	Years since operation	Vision	Amount of escape of vitreous	Remarks at time of operation
1	Mamon	2	6	Some	No iridectomy, lens expelled with some vitreous on completion of incision
2	Rahmat Ali	1	6	"	No iridectomy, lens expelled on completion of incision with some vitreous
3	Gulab (Two eyes)	6	6	"	Iridectomy, lens extracted on spoon Very bad patient
4 & 5	Harnam Singh	1	5	"	

TABLE B

Showing—

(1) Number of years after operation

(2) Vision

(3) Astigmatism

Number of cases—25

Number	Name	Years since operation	Vision	Amount of escape of vitreous	Astigmatism	Remarks at time of operation
1	Hua Singh	1	$\frac{6}{4.5}$	Unknown	+ 0.75 D cylinder	
2	Miran Bux	7½	$\frac{6}{4.5}$	"	"	
3	Ghulam Hader	7	$\frac{6}{4.5}$	"	+ 0.75 D cylinder	
4	Roha	4½	6	"	+ 1.25 D cylinder	
5	Mohammed Din	1	6	"	"	
6	Rodra	6	$\frac{6}{4.5}$	"	"	
7	Omar	2	$\frac{6}{4.5}$	"	"	
8	Mali	5½	$\frac{6}{4.5}$	"	"	
9	Devi Ditta	3	$\frac{6}{4.5}$	"	"	
10	Ghanya	5	$\frac{6}{4.5}$	"	"	
11	Badh Singh	9	$\frac{6}{4.5}$	"	"	
12	Kaka Shah	6	$\frac{6}{4.5}$	"	+ 0.75	
13	Iddoo	6	$\frac{6}{4.5}$	"	+ 0.5	
14	Shah Din	7½	$\frac{6}{4.5}$	"	+ 0.5 D cylinder	
15	Mehtab Singh	5½	$\frac{6}{4.5}$	"	+ 0.75 D cylinder	

Number	Name	Years since operation	Vision	Amount of escape of vitreous	Astigmatism	Remarks at time of operation.
16	Mamon	7	1/2	Unknown	+ 0.5 D	
17	Dama	3	1/2	"		
18	Harrow	4	1/2	"		
19	Mammond	2	1/2	"		
20	Abdulla	1	1/2	"		
21	Juna	3 1/2	1/2	"		
22	Naonid	4	1/2	"		
23	Tabo	8 1/2	1/2	"		
24	Edoo	6 1/2	1/2	"		
25	Shadi	3	1/2	"		

TABLE C.

Cases in which opacity of the cornea was present
Showing—

- (1) Number of years since the operation
- (2) Vision
- (3) Amount of escape of the vitreous
- (4) Notes made on case sheet at the time of operation
- (5) Notes on points of interest in brackets in the last column

Number of cases—10 (Nine patients One double)

Number	Name	Years since operation	Vision.	Amount of escape of vitreous	Remarks at time of operation (Notes in brackets)
1	Nathu	7	1/2	Drop	Iridectomy
2	Sabho Davia.	5	1/2	Do	Iridectomy
3	Hurkan	4	1/2	Do	Iridectomy
4	Gulaba	6 ms	1/2	Some	No iridectomy.
5					
6	Hurkan	5	1/2	Drop	Lens extracted on spoon
7	Suchet Singh	1	1/2	Do	Iridectomy—Nervous patient
8	Jhandoo	6	1/2	Do	
9	Hakom Singh	1	1/2	Do.	Iridectomy
10	Ramaa Dai	6 ms	Counts fingers at one yard	Do	(Corneal opacity very marked, caused by small pox)

TABLE D.

Cases in which the capsule of the lens was left behind, owing to bursting at the time of operation

Showing—

(1) Number of years since the operation

(2) Vision

(3) Amount of vitreous escape (six cases only)

(4) Remarks noted on case sheet at time of operation

(5) Notes on points of interest in brackets in last column

Number of cases—8

Number	Name	Years since operation	Vision	Amount of escape of vitreous	Remarks at time of operation (Notes shown in brackets)
1	Ako	6 mos	$\frac{1}{8}$		(Capsule needled previously)
2	Ahmad Khan	1 $\frac{1}{2}$	$\frac{1}{8}$	Drop	No iridectomy
3	Nihala	4 $\frac{1}{2}$	$\frac{1}{8}$		
4	Natha	5	$\frac{1}{15}$	Drop	
5	Ahmed	6	Not noted by error	"	Drop of vitreous taken out of right eye on account of tension
6	Diwan Singh	2	$\frac{1}{12}$	"	Iridectomy
7	Gaunsa	6	$\frac{1}{100}$	"	No iridectomy
8	Shib Dial	1	Counts fingers only at 2 yards	Some	Iridectomy (Dense after cataract seen)

TABLE E

Detailed notes on eight cases (seven patients, one having escape of vitreous in both eyes)

CASES WITH DISEASED CONDITION OF FUNDUS

Case 1—Bago Operated on 1 $\frac{1}{2}$ years ago "Drop" of escape of vitreous in both eyes—both extracted on spoon
Vision = $\frac{1}{8}$

States that he had very poor vision in both eyes before cataract developed. Had syphilis. On ophthalmic examination signs of old neuro-retinitis

- Case 2.*—Para Singh Operated on five years ago Vision—can only count fingers Sight was alright for two years after operation Then had high fever with delirium Pupillary reaction very sluggish. Disc pale Retina atrophied, probably caused by malarial optic neuritis
- Case 3* —Utman Dai Operated on one year ago Vision—can only see hand movements Both lenses well extracted in the capsule with a “drop” of escape in the right Disseminated choroiditis seen in both eyes on ophthalmoscopic examinations
- Case 4* —Edoo Operated on five years ago Trace of escape of vitreous in right eye Left eye lost previously from trachoma. Vision= $\frac{6}{18}$. Very stupid old man Could give no clear history of his condition Retina presents appearance of retinitis pigmentosa sine pigmento in an early stage
- Case 5* —Ram Singh Operated on $1\frac{1}{2}$ years ago The right lens is noted as having been previously dislocated by the “rawal” or lens coucher at the time of operation It was noted also as having been expelled on completion of the incision with a “drop” of vitreous Note made “Bad patient” Vision= $\frac{6}{18}$. On ophthalmoscopic examination the typical condition of retinitis pigmentosa sine pigmento, which always follows couching of the lens
- Case 6* —Hako Operated on two years ago Vision *nil*. Drop of escape in the left eye Lens noted as dislocated at the time of operation The same fundus condition as in case No 5 but more advanced
- Case 7* —Khuda Bux Age 60 Operated on $4\frac{1}{2}$ years ago Escape of vitreous in one eye only, amount not noted Both lenses extracted in the capsule Primary optic atrophy in both eyes

NOTE.—The details of eleven cases are not given The cases were all tabulated, and the data given elsewhere were calculated from these cases Unfortunately the case sheets with table attached, has been lost, in the course of packing up and destruction of accumulated papers necessitated by a change of station in India No case had any retinal disease or detachment and all had good vision.

